US Army Corps
Of Engineers
San Francisco District

Crescent City Harbor
Del Norte County, CA

General Investigation Study
Final General Reevaluation Report
and
Environmental Assessment

September 1999

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The specific planning objective of this general reevaluation report (GRR) is to identify the solution to reduce tidal delays for vessels, which transit the access channel between the Small Boat Basin, Citizen's Dock, and the existing inner harbor channel.

The purpose of this GRR is to determine whether there is a Federal interest in improving navigation in the Citizen's Dock and Small Boat Basin access channel in Crescent City Harbor, Del Norte County, California.

It was determined the NED (National Economic Development) plan would be a channel at -14 feet MLLW (Mean Lower Low Water), plus one-foot of advanced maintenance and one-foot of overdepth tolerance, with a total volume of 37,700 cubic yards to be dredged. The advanced maintenance would provide shoaling material channel space for a five-year O&M cycle. The proposed channel would extend from the present Federally maintained Inner Harbor Channel to the Small Boat Basin. It would vary in width from 140 feet to 210 feet and be 1,200 feet in length. The Benefit-Cost Ratio would be 2.6.

The environmental impacts would not be significant. Therefore, an Environmental Assessment and a FONSI (Finding of No Significant Impact) were prepared.

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and
Environmental Assessment

September 1999

FINAL

GENERAL REEVALUATION REPORT

CRESCENT CITY HARBOR
GENERAL INVESTIGATION STUDY

DEL NORTE COUNTY,
CALIFORNIA

Prepared By:

U.S. Army Corps of Engineers
San Francisco District

September 1999

EXECUTIVE SUMMARY

The purpose of this general reevaluation report (GRR) is to determine whether there is a Federal interest in improving navigation in the Citizen's Dock and Small Boat Basin access channel in Crescent City Harbor, Del Norte County, California. The proposed project would be essentially the same as the 1965 Federally authorized project except the channel would extend approximately 350 feet to reach the entrance of the Small Boat Basin that was constructed in 1974. This report describes the navigation problems and develops the selected alternative to solve these problems by incorporating and expanding on information obtained during the reconnaissance study. Report alternatives include a basic structural plan with several channel depth variations and a no-action plan. Several dredged material disposal site options were reviewed. This report analyzes the costs, benefits, and environmental impacts of the selected plan and concludes by recommending the plan for construction.

The specific planning objective of this GRR is to identify the solution to reduce tidal delays for vessels, which transit the access channel between the Small Boat Basin, Citizen's Dock, and the existing inner harbor channel.

The Federal objective in water resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders and other planning requirements. Accordingly, it was determined the NED (National Economic Development) plan would be a channel at –14 feet MLLW (Mean Lower, Low Water), plus one-foot of advanced maintenance and one-foot of overdepth tolerance, with a total volume of 37,700 cubic yards to be dredged. The advanced maintenance would provide shoaling material channel space for a five-year O&M cycle. The proposed channel would extend from the present Federally maintained Inner Harbor Channel to the Small Boat Basin. It would vary in width from 140 feet to 210 feet and be 1,200 feet in length. A dredge connected to the present pipeline would place dredged material into the Harbor District's Upland Disposal Site. The minimum cost option for the disposal site was increasing the height of the levees by two feet, using material from inside the site and limited imported fill material to increase its capacity. This height increase would accommodate 37,700 cubic yards of dredged material and accompanying water.

The total cost, Federal and non-Federal, is $1,829,000. The annualized total costs, including the five year maintenance cycle, would be $142,600 and the annual benefits would be $374,800. The Benefit-Cost Ratio would be 2.6.

The environmental impacts would not be significant. Therefore, an Environmental Assessment and a FONSI (Finding of No Significant Impact) were prepared. Mitigation would consist of restricting dredging during late August to early November to avoid impacting the salmon and herring fisheries. The upland disposal site would need to be re-surveyed for any threatened or endangered plant species just before construction.

The selected plan is the basis for Federal interest in proceeding to the Preconstruction Engineering and Design (PED) phase. The Reconnaissance Report was certified by HQUSACE on June 8, 1995. At the Reconnaissance Review Conference (RRC), it was concluded that a Feasibility Study would not be required. Alternative A, the selected plan of deepening the locally maintained channel, is essentially the same as the 1965 authorized project. Because a new project authority is not required, further study is being carried out in the Pre-construction Engineering and Design (PED) phase. The General Reevaluation Report (GRR) is the decision document prepared in PED, and addresses the remaining economic and plan formulation concerns. Sufficient detail is provided in the GRR to proceed to plans and specifications.

CRESCENT CITY HARBOR
GENERAL REEVALUATION REPORT
FOR NAVIGATION IMPROVEMENTS
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CRESCENT CITY HARBOR
GENERAL REEVALUATION REPORT
FOR NAVIGATION IMPROVEMENTS
DEL NORTE COUNTY, CALIFORNIA

1. INTRODUCTION

1.1 Study Authority

Authority for this study is contained in the Crescent City Harbor Navigation Project, Del Norte County, California, which was authorized by the Rivers and Harbors Act of 1965 (PL. 89-298). The text from P.L. 89-298, follows:

> "Sec. 301. The following works of improvement of rivers and harbors and other waterways for navigation, flood control, and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and supervision of the Chief of Engineers, in accordance with the plans and subject to the conditions recommended by the Chief of Engineers in the respective reports hereinafter designated. The provisions of section 1 of the River and Harbor Act approved March 2, 1945 (Public Law Numbered 14, Seventy-ninth Congress, first session), shall govern with respect to projects authorized in this title; and the procedures therein set forth with respect to plans, proposals, or reports for works of improvement for navigation or flood control and for irrigation and purposes incidental thereto, shall apply as if herein set forth in full."
>
> "Crescent City Harbor, California: House Document Numbered 264, Eighty-ninth Congress, at an estimated cost of $1,980,000;"

The Reconnaissance Report was certified by HQUSACE on 8 June 1995. At the Reconnaissance Review Conference (RRC), it was concluded that a Feasibility Study would not be required, since the Selected Plan, Alternative A, Option 4, is essentially the same as the 1965 authorized project. Since a new project authority is not required, further study has been carried out in the Preconstruction Engineering and Design (PED) phase. The General Reevaluation Report (GRR) is the decision document being prepared in PED and addresses the remaining economic and plan formulation concerns. Sufficient detail is provided to proceed to plans and specifications upon completion of the GRR.

The Federal interest in navigation is derived from the Commerce Clause of the Constitution and limited to the navigable waters of the United States. Federal navigation improvements in or on these waters are in the general public interest and must be open to the use of all on equal terms. When facilities to accommodate and service vessels, or load and unload cargo are required to achieve the benefits of a Federal project, they are entirely the responsibility of the local interests.

The general navigation features in harbor areas considered eligible for Federal participation include channels, jetties and breakwaters, and basins or water areas for vessel maneuvering and turning.

1.2 Report Purpose and Scope

The purpose of this GRR is to determine whether there is a Federal interest in improving navigation in the Citizen's Dock and Small Boat Basin access channel in Crescent City Harbor, Del Norte County, California. The proposed project is essentially the same as the 1965 authorized project except the channel would extend approximately 350 feet to reach the entrance of the Small Boat Basin, which was constructed in 1974. This report describes the navigation problems and develops the selected alternative to solve these problems by incorporating and expanding on information obtained during the reconnaissance study. Report alternatives include a basic structural plan with several channel depth variations and a no-action plan. This report analyzes the costs, benefits, and environmental impacts of the selected plan and concludes by recommending a plan for construction.

The specific planning objective of this GRR is to identify the solution to reduce tidal delays for vessels, which transit the access channel between the Small Boat Basin, Citizen's Dock, and the existing inner harbor channel.

1.3 Non-Federal Sponsor

The Non-Federal sponsor for this study is the Crescent City Harbor District. A public workshop was held during the Reconnaissance Study, in March 1989 at which Federal and local agencies, as well as interested parties and individuals, were invited to voice their opinions on the problems and the types of solutions being considered. Another public meeting following the start of this GRR was not held; since, the project alternative selected in this report did not substantially differ from the original 1965 project alternatives presented at the March 1989 workshop.

1.4 Previous Studies

There have been a number of Corps of Engineers studies and reports on Crescent City Harbor and vicinity. Pertinent documents are summarized in Table 1.1 on the following page.

1.5 Planning Process

The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. The traditional Corps planning process consists of two phases which are made up of a series of steps that identify or respond to problems and opportunities associated with the Federal objective and specific State and local concerns, and culminates in the selection of a recommended plan. The objective of the first phase, or reconnaissance phase, is to determine

whether or not planning to develop a project should proceed to a more detailed feasibility phase. The objective of the feasibility phase is to investigate and recommend solutions to water resources problems. The feasibility phase culminates with a Corps of Engineers feasibility report, which serves as the basis for the decision to authorize the recommended project for construction. Following the feasibility report, the Pre-construction Engineering and Design (PED) phase is initiated. The phase includes the preparation of Plans and Specifications for construction.

Since an authority to dredge the Crescent City access channel area already exists, a feasibility study was not conducted. Instead, the project proceeded to the PED phase, as represented by this general reevaluation study prior to the development of Plans and Specifications. This general reevaluation study, which culminates in a GRR is similar to a feasibility study, but with a more limited scope, as its purpose is not to support a new project authority; but, to affirm reformulate, or modify a previously authorized project under current planning criteria.

Table 1.1. Prior Corps of Engineers Studies and Reports.

Report / Document	Scope of Recommendation	River and Harbor Authorizing Act
House Document No. 434, 64th Congress, 1st Session	A breakwater bearing S. 26-1/4 E. from Battery Point to Fauntleroy Rock and breakwater from the shore to Whaler Island	18 July 1918
Rivers and Harbors Committee Document 4, 67th Congress, 2nd Session	Modified condition of local cooperation which required that local interests construct a railroad from Grants Pass, Oregon to Crescent City so that a State Highway to Grants Pass would be an acceptable alternate	22 September 1922
House Document No. 595, 69th Congress, 2nd Session	Extension of the breakwater to a length of 3,000 feet and a reduced cash contribution required of local interests	21 January 1927
Rivers and Harbors Committee Document 40, 74th Congress	Maintaining by dredging of an outer harbor basin, 1,800 feet long, 1,400 feet wide and 20 feet deep, except in rock	30 August 1935
Senate Committee Print, 75th Congress, 1st Session	Construction of a sand barrier from Whaler Island to the mainland and for maintenance dredging in the vicinity of the seaward end of the sand barrier	26 August 1937
House Document No. 688, 76th Congress, 3rd Session	Extension of existing breakwater 2,700 feet to Round Rock (modified by Chief of Engineers, 1952)	2 March 1945

Table 1.1 continued.

Report / Document	Scope of Recommendation	River and Harbor Authorizing Act
Report on file in office, Chief of Engineers by 2nd Endorsement dated 23 August 1943	Construction of inner breakwater and removal of pinnacle rock and other material from the harbor to a depth of 12 feet and a harbor basin with a project depth of 10 feet	2 March 1945
House Document No. 264, 89th Congress, 1st Session	Extension of inner breakwater and dredging of T-shaped harbor basin to depth of 20 feet	27 October 1965
General Design Memorandum for Crescent City Harbor, Crescent City, CA. November 1971	Recommended departures from 1965 authorized project, including extension of inner breakwater from 300 to 400 feet and indefinite deferment of large portion of inner harbor deepening feature	N.A.
Final Report on Crescent City Harbor, Crescent City, CA. For Navigation, August 1972	Described number of harbor improvement alternatives, but did not recommend construction of any alternative due to lack of economic justification	N.A.
Reconnaissance Report, General Investigation Study, Crescent City Harbor, CA. 1980	Recommends 4-year study to obtain detailed information on coastal hydrodynamics and sediment transport for use in designing various dredging and breakwater alignment alternatives	N.A.
Feature Design Memorandum for Inner Harbor Basin and Entrance Channel, Crescent City Harbor, CA. November 1981	Deepening of inner harbor basin and channel to -20 feet MLLW and deepening of outer entrance channel adjacent to tip of outer breakwater to -20 feet MLLW	N.A.
Final Feasibility Report, Shoaling Study, Crescent City Harbor, CA. March 1983	Concluded that adequate authority exists for study and implementation of several alternative solutions for shoaling problem under existing Federal O&M program	N.A.
Reconnaissance Report, Crescent City Harbor, Del Norte County, CA March 1997	Concluded there is an economically feasible solution to the existing navigation problem.	N.A.

1.6 Report Organization

This report is organized into seven sections. Sections 1.0 and 2.0 provide an introduction and description of the project and study area. Sections 3.0 and 4.0 present the problem and the plan formulation. Sections 5.0 and 6.0 discuss technical issues of the selected plan, coordination and public involvement. Section 7.0 presents the conclusions and recommendation of this GRR.

2. STUDY AREA DESCRIPTION

2.1 Description of Study Area

Crescent City Harbor is a small commercial harbor located on the Northern California coast, approximately 280 miles north of San Francisco and 17 miles south of the Oregon Border. Formed by a natural coastal indentation, Crescent City Harbor is defined by a 4,700-foot-long rubble mound outer breakwater which protects the harbor from storms out of the west, a 2,400-foot-long sand barrier and a 1,600-foot-long inner breakwater which protect it from storms out of the south, and by the general contours of the coastline to the northwest. The harbor lies adjacent to the Northern Coast and Klamath Mountain ranges. Measured along the shoreline, the harbor is about one-mile long and faces south. Plate 1 shows Crescent City Harbor and vicinity; including two of the potential dredged material disposal sites: the Ocean Disposal Site southwest of the Harbor and the Crescent City Landfill Site north of the City. Plates 2 and 3 show the Harbor District Upland Disposal Site north of the Small Boat Basin.

2.2 Harbor Location and Description

Crescent City Harbor contains a commercial Small Boat Basin with 240 permanent berths and temporary moorage space for approximately 20 vessels, a 527-slip recreational moorage facility, two fish processing plants with docks, a main dock (Citizen's Dock), a marine repair facility with a synchrolift, a Coast Guard dock, and other auxiliary commercial and recreational facilities. A shallow-depth access channel connects the Small Boat Basin and Citizen's Dock to the Corps' Inner Harbor Channel. The present access channel has approximately the same alignment and width as the proposed new channel design. (See Plate 2)

Harbor traffic consists of both commercial and sport fishing vessels. However, commercial fishing activities constitute approximately 90 percent of the total harbor commerce and are expected to continue to do so in the foreseeable future. In 1995, 21.8 million pounds of fish and shellfish valued at $11.5 million were landed at Crescent City.

The Harbor District constructed the Small Boat Basin in 1974. The current depth in the Small Boat Basin is 10 feet and is maintained by the Harbor District. The Harbor District also maintains the recreational moorage facility to a depth of 10 feet.

2.3 Existing Navigation Project

There are two existing Federally maintained navigation channels at Crescent City Harbor (See Plates 2 and 3). The Entrance Channel begins at the outer breakwater and is 15 feet deep, 2,600 feet long, and 320 to 200 feet wide. The entrance channel connects to the Inner Harbor Channel, which is 1,500 feet long and extends from the entrance channel along the lee side of the inner breakwater. The Inner Harbor Channel was originally authorized and historically maintained at -20 feet MLLW (Mean Lower Low Water). This depth was reduced to -15 feet MLLW in 1993 since it was not economically justified to dredge to the authorized depth. Plate 3 shows the Entrance Channel, the Inner Harbor Channel and the proposed Access Channel.

The present access channel from the Inner Harbor Channel to Citizen's Dock and the Small Boat Basin is not a Federal project. The present access channel was initially dredged to -16 feet MLLW and approximately 150 feet wide for access to the Small Boat Basin. However, this channel has never been maintained to -16 feet MLLW and has shoaled in significantly. In the past, the Harbor District performed limited maintenance dredging to a depth of -12 feet MLLW with their own dredge in the area.

A 16 May 1974 Condition Survey by the Corps shows that the eastern area of the proposed channel, near the present Federal Inner Harbor Channel, was dredged to –16 feet MLLW. The rock depth from an 18 September 1996 boring confirms that depth. The 1974 condition survey and the 1996 borings near Citizens Dock and the Small Boat Basin show rock depths of less than –16 up to less than –15 feet MLLW. The –15 feet MLLW rock depth was used for construction cost estimates.

2.4 Economic Centers

The 1998 population of Del Norte County was 28,900 and Crescent City was 8,700. Since 1970, the County has shown a steady annual population increase of 6 percent. Based on this steady growth, the population in the year 2000 is expected to reach over 30,000. Approximately 30 percent of the County population reside within Crescent City. Lumber, agriculture, commercial fishing, and tourism are the principal sources of economic activity. Crescent City, the economic center of the County, is the location for a majority of the professional, commercial, and science oriented activities.

2.5 Transportation

2.5.1 Water Traffic.

Water traffic consists primarily of commercial and sport fishing vessels. Commercial fishing activities make up approximately 90 percent of the total harbor commerce and are expected to continue in the foreseeable future. The latest available data indicate that 21.8 million pounds of fish and shellfish valued at $11.5 million were landed at Crescent City in 1995.

The commercial fishing vessels are moored in the harbor's small boat basin inside the inner harbor area immediately north of Citizen's Dock. The berths in the boat basin range from 30 to 70 feet in length. All of the 70-foot berths that accommodate vessels in the 61- to 80-foot class are currently leased and, according to harbor operators, there is a waiting list for new renters. The berths may be leased for one year terms. (See Appendix B, Economic Analysis)

Besides the permanently based boats, the harbor accommodated approximately 560 transient vessels between October 1993 and September 1994. Depending on the availability of slips in the small boat basin and the size of the transient vessel, the vessels are docked either in the small boat basin or at Citizen's Dock. Citizen's Dock is a publicly owned, Y-shaped wooden dock originally constructed in 1950 and operated by the Crescent City Harbor District. It is primarily used for unloading the commercial fishermen's catch and for refueling and loading ice.

Citizen's Dock is also used by boats that cannot be accommodated in the small boat basin due to vessel size, low tides, insufficient number of slips, or a combination of factors. The Crescent City Harbor, particularly Citizen's Dock, is used by transient vessels as a harbor of refuge.

2.5.2 Land Traffic.

U.S. Highway 101 is the main land traffic artery. It passes by the Harbor area with a full view of the project area.

2.5.3 Air Traffic.

There are two airports in the general vicinity of the Harbor. The Eureka/Arcata commercial airport is near Eureka approximately 80 miles to the South. There is a small airport at Crescent City, just north of the harbor.

3. PROBLEMS AND NEEDS

3.1 General

The objective of Federal projects is to formulate solutions, which alleviate problems and take advantage of opportunities in ways that contribute to the National Economic Development (NED). Contributions to the NED are increases in the value of the national output of goods and services. The NED objective must be accomplished without unreasonable adverse effects to the environmental quality of the area under study. The plan formulated during this study takes advantage of opportunities in ways that contribute to the NED objective.

3.2 Public Concerns

Public concerns may be expressed directly, such as at a public meeting, or indirectly through Government representatives and agencies, and statutory requirements. Local concern for navigation safety in Crescent City Harbor is evidenced by the support of this study by the Harbor District and Congressional representatives. Since the study began, a public meeting was conducted during the reconnaissance phase to identify the specific concerns of the public.

3.3 Problems and Opportunities

The Harbor District believes there is a need to provide a channel with a consistent depth from the Small Boat Basin to the deeper Federally-maintained Inner Harbor Channel to eliminate tidal delays, safely accommodate larger vessels, and increase the efficiency of the harbor. The Harbor District is seeking Federal assistance to deepen and maintain the channel to adequate depths.

The commercial fishing boats are experiencing navigation channel difficulties transiting the access channel. There are 14 fishing vessels that have a keel depth of 11.5 feet. An additional 2.5 feet depth is needed for squat and safe clearance. Due to insufficient protection of boat keels and channel a depth of only 10 feet, the recreational moorage facility along Anchor Road is not used by the commercial fishing fleet. The large area of shallow water would make deepening access to this dock inefficient. The access channel has been shoaling near the small boat basin entrance to the north wing of Citizen's Dock and out along the access channel leading into the Federally-maintained channel. (See Plate 4) Over the years, the shoaling has worsened, restricting access for fishing vessels, particularly for the larger boats, which must use the tide. This restricted channel depth results in delays and vessel damages to the larger boats. The vessel delays can be divided into two categories: delays for the larger vessels and indirect delays for the smaller vessels. Larger vessels are delayed directly when they cannot load or unload in time to use the tide. Once they miss the tidal window, they must wait until the tide allows them to depart safely. Smaller vessels are delayed when the tide traps the larger vessels, blocking access to Citizen's Dock and preventing subsequent vessels from entering. This type of delay will affect a boat regardless of its draft. These problems are described in more detail in the Economic Analysis in Appendix B of the GRR.

The Harbor District maintains the boat basin to a depth of -12 feet MLLW and performs limited annual dredging in the boat basin entrance area. Restricted by its dredge plant and equipment's capability, the Harbor District is finding it difficult to maintain sufficient water depths. Since the shoaling rate is much smaller inside the Small Boat Basin, the Harbor District does not have a problem maintaining the Small Boat Basin to adequate depths. The controlling problem is their inability to deepen and adequately maintain the rapidly shoaling access channel.

3.4 Planning Constraints

Planning constraints are significant concerns that must be considered during plan formulation. The following potential planning constraints were identified for this study.

3.4.1 Dredged Material Disposal Location

Availability of a dredged material disposal site is critical to any dredging project, since a project cannot be constructed without a disposal site that is environmentally and economically feasible. Several disposal site options were considered in the reconnaissance study and in this study. All had some degree of uncertainty regarding their potential use. However, through the planning process one site was determined to be feasible for the initial project construction. Maintenance dredged material would be deposited in another disposal site. After certain approvals are accomplished, maintenance dredged material from the two Federal channels and the channel recommended in the GRR will have the same new disposal site. (See Section 5.5.)

3.4.2 Characterization of Dredged Sediments

Another key component in the development of a dredging project is the composition of the sediments proposed for dredging. This is important when selecting the most appropriate dredging method and determining the suitability of the dredged material for disposal at a given location. Sediment sampling and testing was completed during the GRR study to finalize the dredging and dredged material disposal plan. The details for the sediment sampling and testing are in Section 4.5 and Appendix A, Attachment 4.

3.4.3 Depth and Area of Rock

Because of the small area of the proposed channel, only five sampling points were taken to identify depth, extent, and type of rock in the channel area of the selected plan. Cost estimates are based on that data. A hydrographic survey was performed 31 January 1998 and cost estimates were calculated based on volumes determined from that data.

4. PLAN FORMULATION

4.1 Overview

The major cause of navigation delay to and from Citizen's Dock and the Small Boat Basin is an access channel with inadequate depth for safe, unrestricted navigation. Therefore, the proposed plan to alleviate the tidal delay problem is to deepen and maintain the access channel from the Inner Harbor Channel to Citizen's Dock and the Small Boat Basin.

This report addresses two alternatives -- an Action Alternative and a No-Action Alternative. The action alternative is evaluated with several channel depths of dredging and one disposal method option, as discussed in the following sections. The final determination of the most appropriate dredging and disposal method are made in Section 5., Selected Plan.

4.2 "Without Project" Condition

The Corps of Engineers planning guidance requires analysis of the "without project" condition as one of the alternatives. Also, in order to comply with the requirements of the National Environmental Policy Act (NEPA), a "no action" plan must be included in the alternative array. The "without project" condition is synonymous with the "no action" plan. The no action plan also forms the basis against which all other alternative plans are measured. The no action plan would leave the Harbor channels in their existing condition. The non-Federal navigation channels would continue to be inadequately maintained at -12 MLLW for providing safe, efficient passage for the commercial fishing vessels. Once the vessels miss the tidal window, they must wait until the tide allows them to depart safely. Each year 163 vessels are affected by 198 hours of tidal delay at an average annual cost of $414,928. Smaller vessels are delayed when the tide traps the larger vessels, blocking access to Citizen's Dock and preventing subsequent vessels to enter. This type of delay will affect a boat regardless of its draft. This situation would continue to cause vessel delays and other transportation inefficiencies in the fishing industry. Detailed descriptions concerning tidal and other delays are presented in the Economic Analysis in Appendix B.

The current practice of vessel operators is to operate with a foot or less of underkeel clearance. Several local fishermen noted that although it would be difficult to quantify, operating with less than one foot underkeel clearance causes damage to the vessels' rudders. Furthermore, without proper underkeel clearance, a boat is more difficult to maneuver and the vessel operator is at an increased risk of losing control of the vessel or running aground in a narrow channel.

The without project conditions corroborate the economic analysis and the benefit projections. The last hydrographic survey (January 1998) shows that portions of the access channel had shoaled to 10.5 feet MLLW. This depth coupled with a shoaling rate of approximately 0.4-foot per year in the proposed channel area clearly shows the current channel depth to be a factor in limiting the efficiency of navigation. The no action plan assumes that the Federal government would not deepen and subsequently maintain the access channel, and the Harbor District would maintain the channel to the best of its abilities. If no action were taken,

the access channel would most likely remain at a depth, which would continue to cause tidal-related navigation delays for boats transiting to and from the existing Federal channel, Citizen's Dock, and the Small Boat Basin.

4.3 Description of Alternatives.

All the alternatives considered during the GRR study are described here. Several reviewers of the Interim Review Conference Package and Draft GRR suggested a variety of alternatives. The text below describes these alternatives and what factors caused them to be held or rejected.

4.3.1 Anchorage Area

The deepest draft tidal delayed vessels block access to fuel and ice facilities needed by other vessels, regardless of their draft. Development of an "anchorage area" for the largest vessels could prevent the indirect tidal delays for vessels not tide constricted. The cost of the anchorage area for 32 large vessels may be less than the channel deepening costs needed to eliminate delays to the fleet of 163 ships. This alternative was discussed with the Sponsor.

Based on local sponsor input at the conference, the development of an anchorage area within the outer harbor area was determined to be unfeasible. The contributing reasons for this decision are: (1) the outer harbor is exposed to more severe wind and wave conditions than the small boat basin; (2) the outer harbor has shallow depths and rapid shoaling rates which would result in substantial maintenance dredging requirements; (3) an anchorage area could generate safety concerns due to possible infringement on the entrance channel; and (4) an anchorage area, while eliminating some of the indirect delays to smaller vessels, would not eliminate delays to the larger vessels, and in some cases, could actually increase delays to these larger vessels. The larger vessels would still need to off load at the dock in the small boat basin when Citizens Dock is in full use. Therefore, further evaluation of this alternative is not warranted.

4.3.2 Inner Harbor

The Inner Harbor Alternative was investigated to evaluate whether it is more cost effective to provide services needed by the larger vessels at the Inner Harbor area rather than Citizens Dock. The Inner Harbor is the area bounded by Citizens Dock, the inner breakwater, Anchor Road, and the shoreline where the two fish processing plants are located. Information was provided by the Harbor Master at the Crescent City Harbor District. All of the shore line property in the "Inner Harbor" area is owned and used by the U.S. Coast Guard, the Abalone International Company, and the recreational boat marina. The Harbor Master reports there are several large rock columns near (and just above) the water surface in the same area. In addition, in the Inner Harbor area, new berths, docks, and servicing facilities would need to be constructed. It is apparent that this alternative would cost substantially more than the recommended plan and would not be economically justified.

4.3.3 Access Channel

The plan of improvement for this project is dredging an access channel from the existing Federal channel to the entrance of the Small Boat Basin. (See Plate 3). The approximate length of the access channel is 1,200 lineal feet. The bottom width of the channel design varies from a minimum of 140 feet to a maximum of 210 feet near the existing Federal channel. The access channel will be wider at Citizen's Dock, and will extend to the northwest side of the Dock. Plate 3 shows the extra width at Citizens Dock as the recommended non-Federal Access Channel. This will allow boats to navigate to the berthing area at the dock through a deeper channel. The Federal channel would not be used as a berthing area. The excavated channel side slopes will be 1 vertical on 3 horizontal. A typical cross section of the channel dredging is shown on Plate 3.

This report has evaluated the dredging of the access channel at five depths. The five depths are: -15 feet MLLW with 2 feet of overdepth, -14 feet MLLW plus one-foot of advanced maintenance and one-foot overdepth, -14 feet MLLW plus 1 foot overdepth, -13 feet MLLW plus one-foot of advanced maintenance and one-foot of overdepth, -13 feet MLLW plus one-foot of overdepth. See table 5.2. The rock is assumed to be present at -15 feet MLLW and below. Hence, the two feet of overdepth at -15 MLLW and below are to meet the safety requirement for an additional one foot in rock. The rock is discussed in the Geo-technical Section of this report. (Appendix A, Engineering Analysis) The range of volumes is 22,500CY for the -13-foot MLLW to 42,500CY for the -15-foot MLLW with 2-foot overdepth. (See Appendix A, Sec. 5.1.1)

The access channel outline was located by coordinates, which are listed on Plate 3. The coordinates are based on the California Coordinate System Zone 3, North American Datum 1927 (NAD 27) datum.

4.4 Disposal Site Options

4.4.1 Nearshore/Ultimate Upland Disposal

The Crescent City Harbor District owns and operates an upland dredged material disposal site. This site, located just north of the Small Boat Basin (refer to Plate 3), is the recommended disposal alternative. The remaining site capacity is approximately 27,000 CY. There are two options to provide the volume of space needed to dispose of dredged material from the channel extension. One would be to remove dried material from the disposal site and transport it to the Del Norte Solid Wastes Management Authority landfill site approximately five miles from the Harbor. The other option would be to use the dried material within the disposal site to increase the levee height enough to provide the volume needed. It was determined, in order to accommodate the range of dredged material from the depth options described in Section 4.3.3, the upland disposal site would need a capacity of approximately 63,000 cubic yards (CY). Removing 36,000 CY from the present site would cost $180,000 and be below the sea level water table. This action would not be an acceptable engineering practice. The raising of the upland site levees would cost $265,000. The construction would use material in the site down to the sea level water line and import additionally needed material to raise the levees. The details are described in Section 5.

There would not be any O&M for the upland disposal site. The plan is to use the site for storage of the construction material, then close the site. Future O&M for the existing and new channels would occur every five years with average dredge material volume of 76,000 CY. It is not practical to increase the height of the levees to accommodate this volume of material and associated space for water retention. Geo-technical analysis indicates a higher levee would require more volume of material to maintain a safe design than the volume of storage gained within the disposal site. In addition, a higher levee would cause the view of the harbor from the hotel behind the disposal site.

4.4.2 Ocean Disposal Site

The Ocean Disposal Site considered was an interim site known as SF-1, which is located approximately 1.3 miles southwest of Crescent City Harbor (refer to Plate 1). The site covers approximately 0.2 square miles and has an average depth of 90 feet. SF-1 was used for past harbor maintenance dredging episodes by obtaining a project-specific designation (Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1977) from the Environmental Protection Agency (EPA). However, the interim site designation expired in 1997, and the EPA has recommended studies for a Section 102 (of the previously mentioned Act) permanent site designation be conducted. Construction-Operations Division, San Francisco District and the Directorate of Construction-Operations, South Pacific Division have indicated the need for a Section 102 permanent site. A permanently designated ocean disposal site is not available at present. A Section 103 project-specific designation could be sought. EPA would be asked to approve a 102 site designation and a site management and monitoring plan. The ocean site would be used once every five years. The monitoring program would be expected to be minimal. The program would not increase in cost as a result of the increased maintenance dredging quantity from the recommended project.

It is possible, with the proper environmental documentation, the Ocean Site could be available for use for disposal of O&M dredged material, from the present Federal channel and the proposed extension channel combined. The usual O&M volumes of 60,000 CY for the present Federal channels and 16,000 CY for the proposed extension channel, totaling 76,000 CY, would be far more dredged material than "practicable" for disposal in the upland disposal site. Section 5.5.2 Ocean Disposal Site Designation Action Plan, describes the tasks needed to accomplish the establishment of a Section 102 ocean disposal site for O&M. Designation of an ocean disposal site is likely because (1) the volume of maintenance dredged material would be greater than the capacity of the upland site, and (2) the site would be used once every five years. These two factors are major reasons an ocean site could be considered for designation by EPA.

4.4.3 Whaler Island Beach Nourishment

Whaler Island is located in the southern area of the harbor and is connected to land and Anchor Road from the northeast. The Inner Breakwater connects to the island from the northwest. The Harbor District has a permit to deposit dredged material sand on the Whaler Island beach. However, the material must be 80-percent or more sand and must have very low

quantities of organic materials. Dredged material from the proposed access channel does not meet those qualifications. Tests show the sand quantity is too low and the organic material quantities are considered too high for beach placement. The material that shoals into the Federal Entrance Channel does qualify for beach placement on the island. Therefore, the island is a likely site for placement of dredged material from the Entrance Channel for O&M purposes.

4.4.4 Comparison of Disposal Options

The District compared the previously used ocean disposal site and the upland disposal site as a possible least cost options. Whaler Island was not considered as a dredged material disposal site. The dredged material does not meet quality criteria for beach nourishment. An MCACES construction cost estimate and a cost estimate for tasks involved in an EIS for a Sec. 102 ocean site designation were prepared for construction alternatives using the upland and ocean disposal sites. The construction tasks for the upland site would include using a hydraulic dredge and pipeline to an upland disposal site. The construction tasks for an ocean site would include using a clamshell dredge and powered barges to haul dredged material to an ocean site location. The Environmental Assessment (EA) document costs for both alternatives were assumed to be the same in both of the MCACES analyses. The term "Net NEPA" represents the additional costs of the EIS for the ocean site over the EA/FONSI for the upland disposal site option. (See Section 4.4.1. above.) The disposal option costs are compared in the table below.

COMPARISON OF COSTS
UPLAND DISPOSAL & OCEAN SITE ALTERNATIVES
(Estimated Channel depth of –15 MLLW)

Construction	$1.546M	$1.473M
Site Preparation	0.265M (Upland)	0.0 (Ocean)
Net NEPA	0.0	0.600M
	$1.829M	$2.073M

The tabulation shows the overall cost for using the upland disposal site is the least cost option. Therefore, all the depth alternatives considered for economic analysis used the upland disposal site. In addition to the greater cost, there could be a delay in construction of three to four years due to the testing, writing, reviewing and approving needed to establish a Sec. 102 site. A new ocean disposal site approval would most likely include a monitoring program, which would incur additional costs.

There is one overriding factor concerning the ocean disposal site. The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) Subpart C – Need for Ocean Dumping, discusses the factors by which an ocean disposal site may be approved. Specifically 40CFR Ch. 1, paragraphs 227.16 (a), (a)(2), and (b) indicate an ocean site should be considered only when "there are no practicable alternative locations and methods of disposal or recycling available...". Because the upland disposal site is practicable and available, it is unlikely that EPA would authorize use of the ocean site for construction.

4.5 Dredged Material/Sediment Quality

The Corps tested the material to be dredged in September 1996 to assess suitability for disposal at the designated upland site located just landward of the inner harbor shore. Based upon review of the test data, the project material is considered by the Corps to be suitable for placement at the designated site.

Cored samples of project material were subjected to bulk physical and chemical analyses in order to characterize contamination. Samples of the material were subjected to a Modified Elutriate Test which is a prescribed test generating a water extract of dissolvable substances from the sediment. This laboratory procedure indicates the character of impounded dredged slurry water to assess effects of runoff or discharge. The samples were analyzed by Battelle Marine Laboratory. The chemical categories tested were: metals, chlororganics, PAHs, and butylytins.

Of the metals, nickel and chromium are notable in that the levels are in several hundreds mg/kg. While somewhat elevated, these levels are unexceptional in the Crescent City area. The elutriate values show that the bulk nickel did not detectably contribute to dissolved nickel while chromium contributed approximately 1 ug/l (ppb), an insignificant level.

Chlorinated pesticides were detected at very low levels. Aldrin was found to be present at 0.6 to 1.7 ug/g. The DDT breakdown product, 4.4'-DDE was found at 2 to 3 ug/g. At 1 to 2 ng/l detection limit (parts per trillion), aldrin was not detected in elutriate while a low measurable level, 3 ng/l of 4,4'-DDD was measured in elutriate. PCBs were not detectable in either bulk or elutriate. PAHs were found at levels of tens of ppb's in bulk sediment, but not detected in elutriate except for ubiquitous phenanthrene at the barely detectable value of 17 parts per trillion. PAH values fall in normal background range.

The two criteria used for this proposed project, which affect the choice of where dredged material can be placed are grain size and organic material content. The SPD Laboratory completed the bulk physical analysis. The Battelle Marine Science Laboratory performed the total organic carbon (TOC) testing. The grain size analysis of the five samples (CC-1 – CC-5) reveled gravel content ranged from zero to 38-percent, sands ranged from two to 51-percent, and fines ranged from 98 to 7-percent. The details are in Attachments 3 and 4 of the Engineering Analysis in Appendix A. The TOC in the same five samples ranged from 4.80 to 12.8-percent. The general criteria for beach nourishment are 80-percent or more sand material and "low" TOC content. The Crescent City samples do not meet either of these criteria.

In summary, given the low chemical contamination character of the project material, the insignificant biological activity at the disposal site, and the insignificant contamination levels indicated by the elutriates for fluid discharge, no significantly adverse environmental effects due to placement of this material at the designated upland disposal site are anticipated.

4.6 Plan Selection

The selection criteria for determining the selected plan are described in ER 1105-2-100. Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

As described above, the Access Channel plan would meet these four criteria. The Access Channel plan was carried forward from the Reconnaissance Study to the General Reevaluation Report, as approved by HQUSACE. The cost and benefits for a range of channel depths were calculated. The NED (National Economic Development) Plan "reasonably maximizes net national economic development benefits, consistent with the Federal objective." (Planning Manual, November 1996, IWR report 96-R-21, inside front cover) Based on the economic evaluation the NED plan is the channel depth of –14 feet MLLW with 1-foot of advanced maintenance and 1-foot of allowable overdepth. (See Section 5.6.2, page 23 and Table 5.2 on page 24.) The NED plan is the Selected Plan.

5. SELECTED PLAN

5.1 Description of Selected Plan

5.1.1 Selected (NED) Plan.

The selected (NED) plan is an Access Channel at -14 feet MLLW (Mean Lower Low Water), plus one-foot of advanced maintenance and one-foot of allowable overdepth. The advanced maintenance would provide shoaling space for a five-year operation and maintenance (O&M) cycle. The proposed channel would extend from the present Federally maintained Inner Harbor Channel to the Small Boat Basin. It would vary in width from 140 feet to 210 feet and be 1,200 feet in length. See Plate 3. A dredge connected to the present pipeline would place dredged material into the Harbor District's Upland Disposal Site. The minimum cost option for upgrading the disposal site consists of increasing the height of the levees by two to three feet by using material from inside the site and limited offsite material to increase its capacity to 63,000 cubic yards (CY). The levee height increase would accommodate the 37,700 CY of dredged material and space for the water pumped with the dredged material.

5.1.2 Operation and Maintenance (O&M)

The first O&M dredging would be expected five years after project construction. The present two Federal Channels and the proposed project channel would be combined into one operation producing an estimated average quantity of 76,000CY of O&M dredged material every five years. The 76,000CY includes 50,000CY from the two present Federal channels and 16,000CY from the new Access Channel. The primary disposal location would be a newly designated ocean site. The Whaler Island beach nourishment site could be available for qualifying sand material from the Entrance Channel and the other channels. An action plan to designate an ocean disposal site is underway. Plate 3 shows the location of the Federal channels and the proposed Access Channel.

5.2 General Design Considerations

The design of general navigation features was accomplished in accordance with Corps criteria, procedures, and standards to accommodate the actual and projected vessels calling at Crescent City Harbor. The information on the vessels and their operations in the navigation channels was obtained from the Crescent City Harbor District documents.

5.2.1 Channel Design

The channel width design dimensions are based on design vessel dimensions and guidance contained in ER 1110-2-1615, "Hydraulic Design of Small Boat Harbors." Several channel alternatives of varying widths were initially considered, but no additional benefits could be gained through channel widening beyond the minimum acceptable width. Therefore, a minimum acceptable channel width design was developed. Based on dimensions of the design vessel and factors in Table 3-1 of EM 1110-2-1615, the recommended channel design is a

minimum two-way traffic channel with a width of 140 feet to a maximum of 210 feet near the existing Federal channel. From the economic optimization, the recommended depth of the channel is -14 feet based on a cutterhead hydraulic dredging operation. (See Table 5.2, page 25) The recommended channel would allow significantly improved access and eliminate most of the direct and indirect tidal delays, although extreme negative tides may cause minor tidal delays several times a year. A 1V:3H slope cut would be used for the sediment material side-slope stability. This is consistent with the design of the Inner Harbor channel.

5.2.2 Design Vessel

The Crescent City Harbor District provided information to aid in defining the design vessel for the access channel to the Small Boat Basin. Consultation with the Harbor District and examination of the existing fleet information indicates the proposed channel should be built to accommodate an 80-foot-long vessel with a 24-foot beam. The vessel design draft is 11.5 feet. The total channel depth for the design vessel is 13 feet (see Appendix A, Engineering Analysis). The recommended channel depth was determined by an economic optimization analysis (See Appendix B and Section 5.6).

5.2.3 Design of Navigation Features

5.2.3.1 Tides

Tides in the Crescent City Harbor area are characterized by the diurnal inequality common to the Pacific Coast, with a difference of several feet between the two high tides and two low tides in a 24-hour period. The mean diurnal range of tide is 6.9 feet, and the extreme range is 12.9 feet (2.9 feet below MLLW to 10.0 feet above MLLW). Tides below datum occur twice each month for several days in succession. Water levels for Crescent City Harbor are presented in Table 5.1 below.

Table 5.1 Water levels for Crescent City Harbor.

Extreme High Water	10.0 feet
Mean Higher High Water (MHHW)	6.9 feet
Mean High Water (MHW)	6.3 feet
Mean Tide Level (MTL)	3.8 feet
Mean Sea Level (MSL)	3.6 feet
Mean Low Water (MLW)	1.2 feet
Mean Lower Low Water (MLLW)	0.0 feet
Extreme Low Water	-2.9 feet

5.2.3.2 Currents

Currents within Crescent City Harbor are predominantly tidally-influenced, and occur as the water level in the harbor rises and falls. Currents can also be wind-induced, when strong winds cause surface waters to flow in the direction of the wind. Although measured current data within the harbor are not available, current velocities within Crescent City Harbor are suspected to be weak, due to the sheltered nature of the harbor. Currents have not been a problem to fishing vessels, and significant changes to existing current patterns or velocities are not expected as a result of the proposed project.

5.2.3.3 Waves

The coast of northern California is subject to severe winter storm waves that generate waves from the northwest to the south directions. The prevailing winds in the summer and the fall are from the north and northwest. Since the outer breakwater at Crescent City effectively protects the harbor from waves from the west to northwest, the critical waves are from the south and west-southwest. The Inner breakwater and the 400-foot-long extension also provide wave protection to the Small Boat Basin and Citizen's Dock.

Measured wave data within the harbor are not available. Physical model studies used to optimize the design of the inner breakwater extension showed that the severe offshore wave conditions were considerably attenuated by the outer and inner breakwaters. The current navigation problems are not attributed to the wave conditions in the harbor, and deepening the access channel will not change wave conditions.

5.2.3.4 Harbor Sediments

Sediment Physical Properties -- Sediments previously dredged in the inner harbor area have been silty sands with a few organics. Cobbles and gravel, which may be the remnants of an old river bed, have been encountered in previous maintenance dredging, according to harbor personnel. The September 1996 samples were comprised of dark gray sands containing organic material ranging from fine grained to medium and loose, to dense medium grained sands.

Sediment Sources -- A littoral transport study by Roberts (1970) identified four possible sources of sediment material in Crescent City Harbor. These sources were Elk Creek (which empties into Crescent City Harbor), aeolian (windblown) material, redeposition of dredged material, and littoral transport of beach sands. Of these four possible sources, littoral transport was identified as the only source with significant potential to deposit sediment. However, no predominant direction of sediment transport could be identified, and the study suggested that material is moving into the harbor from both north and south directions.

5.2.3.5 Littoral Transport

During summer months, storms are infrequent and wave action in the harbor vicinity is moderate. During winter months, the area is subjected to severe wave action, and waves in

excess of 25 feet occur in the immediate harbor vicinity. The outer breakwater protects the outer harbor from west- and northwest-approaching waves and provides partial protection from southwesterly winter storm waves. The outer and inner breakwaters together provide almost complete surface wave protection to the inner harbor basin. However, these breakwaters do not completely prevent wave-generated sand transport into the harbor.

Littoral drift in the Crescent City Harbor region is generally from the north. The primary sediment source north of Crescent City is the Smith River, and a broad beach with sand dunes extends southward from this source. Sediment is transported from the mouth of the Smith River 9 miles south to Point St. George. However, beach sand south of Point St. George is of local origin, indicating that most southward-moving sediment from the Smith River basin is lost to deep water by the time it reaches Point St. George. Deep water sediments could move into the harbor during northwesterly, southwesterly, or southerly wave conditions, or around the harbor and on to South Beach or more southerly beaches. Littoral transport along South Beach, directly south of Crescent City Harbor, is primarily controlled by the angle of wave incidence, with sediment sometimes being transported north toward Crescent City by an eddy current of the prevailing southerly coastal currents. Also, local wind-driven currents may contribute to northward littoral drift patterns. (See Plate 4)

5.2.3.6 Harbor Shoaling

Areas of Accretion -- Within the calmer waters of the harbor, sand is deposited on the harbor bottom. A feasibility study on shoaling at Crescent City Harbor (Corps, 1983) identified four general areas of sand accretion within the harbor. The areas identified were: 1) the entrance channel from the southeasterly end of the outer breakwater to Fauntleroy Rock, 2) the beach and quaywall from the boat basin entrance channels, west and northwest along the shoreline to the outer breakwater, 3) the area between the north wing of Citizen's Dock and Pelican Rock, and 4) inside the dogleg of the inner breakwater at the now-abandoned oil terminal (see Plate 4). As shown in Plate 4, the beginning of Area 2 coincides with the location of the small boat basin access channel, where shoaling continues to be problematic.

Shoaling Rate -- Crescent City Harbor has experienced continued shoaling since construction of the inner and outer breakwaters. Available surveys show shoaling was greatest along the edges of the harbor, particularly the landward edge. A flat beach built up rapidly after construction of the initial stage of the outer breakwater. The build up of this beach slowed after construction of the sand barrier in 1939. In addition to deposition along the beach, a layer of sand several feet thick deposited over a large portion of the harbor, and the average shoaling throughout the harbor was estimated between 80,000 and 100,000 cubic yards (Corps, 1981). The estimated, overall shoaling rate for the access channel is approximately 0.4 feet per year for post project conditions. This is based on comparisons of pre-dredging surveys of the Inner Harbor Channel from 1993, 1995 and 1998. Harbor District personnel indicated that the access channel shoals from west to east, with the area adjacent to Citizen's Dock shoaling in slower than the western edge of the access channel. Shoaling in the Small Boat Basin is much less because sediments can only enter the basin through the 170-foot-wide entrance. The engineering calculations are included in the Engineering Analysis, Appendix A.

5.2.3.7 Rock Outcrops

The bottom materials in the project area are expected to be predominantly sands and silts. One concern is that there could be rock outcrops that could make dredging difficult. A 1970 geophysical hydrographic survey of the area showed potential rock outcropping in the channel alignment as shallow as -12 feet MLLW. However, this survey was taken before the Harbor District constructed the Small Boat Basin, which included dredging the 150-foot-wide access channel down to -16 feet MLLW. A Corps of Engineers hydrosurvey conducted in 1993 and a sample point survey shows that rock in the access channel was at -15 feet MLLW.

For cost estimating, rock is assumed to occur below -15 feet MLLW. The rock consists of fractured sandstone that could be excavated without blasting. This assumption is based on the September 1996 sediment survey within the general area of the proposed access channel.

5.3 Disposal Site

Nearshore/Ultimate Upland Disposal -- The Crescent City Harbor District owns and operates an upland dredged material disposal site. This site, located just north of the Small Boat Basin (refer to Plate 3), is the recommended disposal alternative. The Corps would request approval of temporary easements (one year) for road and pipeline easements and a non-standard estate of a temporary work area easement for the disposal site. The one-year, temporary easements are determined adequate for construction, operation, and maintenance of the project. See Appendix C, Real Estate Plan, Sec. 3, for the details.

5.3.1 Remove to Landfill Site

The Crescent City Harbor District does not have a maintenance plan for removing dried material from the disposal site. Material was removed for the first time in October 1997. The county landfill operated by Del Norte Solid Waste Management Authority requested 6,000 CY. The loading and trucking cost were $20,000 paid for by the Harbor District. The Harbor Master reported their costs for loading and hauling the dried material is $3.50 per CY. In future hauls to the landfill there would be a charge of $1.15 per CY for stockpiling the material. However, the 27,000 CY capacity site would not contain the 37,700 CY of dredged material plus the water. Removing enough material from the present site to accommodate the dredged material and water would place the bottom of the disposal site below the sea level water table. This action would not be an acceptable engineering practice. Water acts as a lubricant causing material in contact with the water surface to be subject to slipping. Also, very wet material is difficult to compact.

5.3.2 Raise Levees

San Francisco District also estimated the cost to increase the height of the levee by two to three feet, using the material on site, with limited material from the outside and constructing the levee from inside the disposal site. The preliminary MCACES estimate for this option was $265,100. More details are in the Engineering Analysis, Appendix A. Therefore, increasing the height of disposal site levees appears to provide the optimum additional volume (63,000 CY) for

new dredged material from the construction of the new channel. Raising the levee height is clearly the type of preparation of an upland disposal site which would be cost shared similar to other General Navigation Features (GNF) under Sec 201 WRDA 96. This is the option chosen for the selected plan.

5.4 Dredging Plan

For cost estimating it is assumed there would be one contract for a prime contractor who will execute all the dredging and disposal operations unless noted otherwise. Mobilization and demobilization for plant and equipment is based on the preparation, transfer, set-up and removal of plant and equipment required. The assumed dredging plant consists of one 12-inch cutterhead hydraulic dredge, with approximately 3,000 feet of pipes, and two D7 dozers, a 12CY truck and other misc. equipment for the levee replacement work. The cost estimate assumes that the contractor will dredge all overdepth volume. The order of work would proceed as follows:

The upland disposal site construction:

1) Mobilization of equipment (est. 1 work day)
2) Improvement of upland disposal site (est. 45 work days, 5 days per week)
3) Demobilization of equipment (est. 1 work day)
   (estimated work days are based on 8 hours per day)

The dredging operation

1) Mobilization of plant and equipment (est. 7 work days)
2) Dredging and pumping to disposal area (est. 11 work days)
3) Demobilization of plant and equipment (est.7 work days)
4) Estimated effective working time of 60% (24 hour day, 7 days per week)

Adding the time estimates in sequence gives a contract duration of 83 calendar days. The time duration includes all work items except demobilization of dredge plant and equipment. Dredging is assumed to be accomplished using a 12-inch cutterhead hydraulic dredge and directly pumping the dredged materials to the upland disposal area

5.5 Operation and Maintenance

5.5.1 Requirements

Maintenance for the selected plan would be on a five-year cycle and remove an average of approximately 16,000 CY. The dredged material would be placed in a newly designated, Sec. 102 site, which will be determined though the action plan described in Section 5.5.2 below. Each dredging cycle (5-years) would be in conjunction with the O&M for the present Federal channels. The designated ocean site would become the disposal site for all the Federal channels. All the Federal channels would have an average volume of 76,000 CY of dredged material every five years. Sandy material from the Entrance Channel could be placed on Whaler Island for beach nourishment when needed. The EPA and the State Coastal Commission must approve the

quality of dredged material being proposed for use as beach nourishment. See Section 4.5 for criteria concerning beach nourishment.

5.5.2 Ocean Disposal Site Designation Action Plan

The major steps necessary to designate an ocean disposal site pursuant to Section 102 of the Marine Protection Research and Sanctuaries Act (40 CFR 220 et seq), and the approximate length of time required to complete each phase are described below.

Dredged Material Management Plan (DMMP) -- Initially the long-term disposal needs for Crescent City Harbor was identified in a DMMP completed in July 1999. This process evaluated all disposal options available to the project and determined the best alternative(s) for long term-disposal requirements. When it is determined that an ocean disposal site is required, the Corps will coordinate with the USEPA to obtain their concurrence to designate a 102 site.

Scoping Meeting and Notice of Intent -- A National Environmental Policy Act (NEPA) Scoping Meeting will be held and a Notice of Intent to prepare an Environmental Impact Statement (EIS) will be issued by the Corps in the form of a Public Notice (2 months).

Zone of Siting Feasibility Analysis – A Zone of Siting Feasibility Analysis will be performed to define the area in which disposal of dredged material from the project is both operationally and economically feasible (4-6 months). Included in this phase is a Fisherman's Outreach Survey to locate sites that are in unacceptable areas (4 months).

Selection of Candidate Sites -- After consideration of existing environmental data and potential conflicts with other uses and resources, Selection of Candidate Sites will be made. Evaluation of these sites will include field investigations, estimated to require 12 months to complete, including:

a. Physical and chemical characterization of disposal site sediments.
b. Benthic fauna and infauna surveys.
c. Hydrodynamic features, including sediment fate and transport.
d. Bioaccumulation studies.

Selection of Preferred Site(s) -- Following evaluation of candidate sites, Selection of Preferred Site(s) will be made and a Draft EIS is prepared and distributed for public comments. Following response to public comments, the Final EIS is published and a Final Rule is first proposed and then adopted by USEPA. The Site Management and Monitoring Plan (SMMP) is developed and approved during this phase as well. This process is approximately 18 months.

5.6 Project Economics

5.6.1 Project Costs -- Cost Estimates

The costs of the Crescent City Harbor Selected Plan were determined by the District's Specifications and Cost Engineering Section and include lands and damages, dredging, planning, engineering and design, as well as construction management. Table 5.2 on page 24 presents the total annual costs, which range from $1,710,700 to $3,561,900, for the five project channel depths considered. Project costs rise sharply for depths of -15 feet MLLW and deeper since these projects involve the removal of rock. The costs were annualized using the current (FY 99) Federal Discount Rate of 6.875-percent and an assumed project life of 50 years. The economic details for the -14 MLLW and one-foot of advanced maintenance (AM) option are shown in Table 5.2 on page 24. Details are in Appendix B, Economic Analysis.

5.6.2 Project Economic Benefits

The project benefits are comprised of tidal delay reduction benefits, the reduction in damages to Citizen's Dock, and employment benefits. As shown in Table 5.2 on page 24, the total benefits range from $131,100 for a -13-foot MLLW channel to $423,700 for a -15-foot MLLW channel with an additional 1-foot cut for rock.

There is no expectation for economic savings from the reuse of dredged material. However, the District did investigate the possibility of any savings in the project cost. Landfill owners in the project area do not pay for dredged material. Competition from construction companies, which need to dispose of their excess excavation materials from their projects, precludes a market for the reuse of dredged material.

5.6.3. Benefit/Cost (B/C) Ratio for Selected Plan

The net annual benefits, defined as the project benefits minus the project costs, range from $-3,000 for a 13-foot MLLW depth with no Advanced Maintenance (AM) channel to $232,200 for a 14-foot MLLW depth with AM channel as shown in Table 5.2, page 24. Since the 14-foot with AM project contains the greatest net benefits, it represents the optimal or the NED (National Economic Development) plan. Its respective benefit-cost ratio is 2.6 to 1. A more detailed analysis of the project economics is shown in the Economic Analysis, Appendix B.

5.6.4 Cost Apportionment

If a project has more than one purpose, the costs for the project are shared (apportioned) among the purposes. The single purpose for this project is Navigation, so all costs are apportioned to that purpose.

5.6.4.1 Total Project Investment Cost

The total project investment cost (April 1999) for the selected plan is estimated to be $1,829,000 (rounded). The summary of total costs are shown in Table 5.3, page 25.

TABLE 5.2

Economic Optimization With Average Benefits

Project Depth (ft MLLW)	Advance Maint. (feet)	Over Depth (feet)	Capital Costs	Maintenance Cycle (yrs)	Annualized Capital costs	Annualized O&M Costs	Total Annual Costs	Total Annual Benefits	BCR	Net Benefits
-13		-1	$ 1,710,665	5	$ 122,005	$ 12,173	$ 134,178	$ 131,131	0.977	$ (3,047)
-13	-1	-1	$ 1,766,741	5	$ 126,004	$ 12,173	$ 138,177	$ 273,479	1.979	$ 135,302
-14		-1	$ 1,775,605	5	$ 126,636	$ 12,173	$ 138,809	$ 273,703	1.972	$ 134,894
-14	-1	-1	$ 1,829,415	5	$ 130,475	$ 12,173	$ 142,648	$ 374,836	2.628	$ 232,188
-15	-1	-1	$ 3,561,860	5	$ 254,032	$ 12,173	$ 266,205	$ 423,700	1.592	$ 157,495

NOTES: The MLLW means Mean Lower Low Water.

The total depth for the -15-foot plan will be -17 feet, which includes 2 feet of rock regardless of it's designation, as 2 feet for advanced maintenance and overdepth OR 2 feet of overdepth required in rock.

For this plan it will be referred to as -1ft advanced maintenance and -1ft overdepth.

For the -14,-1,-1 plan, the specifications would indicate to not dredge any overdepth when in contact with rock.

TABLE 5.3

CRESCENT CITY HARBOR SELECTED (NED) PLAN
Total Cost Summary

	QUANTITY	CONTRACT $	CONTIN-GENCY. $	TOTAL COST $
1 FEDERAL COST, Alt. -14'+1'OD+1'AM* (General Navigation Features - Cost Shared)				
1-01 REAL ESTATE ADMINISTRATIVE COSTS	1.00 JOB	$51,700	$0	$51,700
1-02 LERRDS	1.00 JOB	$145,300	$0	$145,300
1-12 NAVIGATION, PORTS & HARBORS	1.00 JOB	$703,606	$103,724	$807,330
1-30 PLANNING, ENGINEERING & HARBORS	1.00 JOB	$699,650	$0	$699,650
1-31 CONSTRUCTION MANAGEMENT	1.00 JOB	$80,000	$0	$80,000
TOTAL FEDERAL COST, Alt. -14' +1'OD +1 AM (For Cost Sharing with non-Federal Sponsor)	1.00 JOB	$1,680,264	$103,725	$1,783,980
2 NON-FEDERAL COST, Alt. -14'+1'OD+1'AM (Local Service Facilities - All Local Cost)				
2-01 LANDS & DAMAGES	1.00 JOB	$15,000	$0	$15,000
2-12 NAVIGATION, PORTS & HARBORS	1.00 JOB	$26,465	$3,970	$30,435
TOTAL NON-FEDERAL COST, Alt. -14'+1'OD+1'AM (Local part of Project Costs Only)	1.00 JOB	$41,465	$3,970	$45,435
TOTAL CRESCENT CITY HARBOR	**1.00 JOB**	**$1,721,729**	**$107,695**	**$1,829,415**

* OD is Over Depth and AM is Advanced Maintenance

TABLE 5.4

COST ALLOCATION FOR SELECTED PLAN

ITEM	COST
General Navigation Features (GNF)	
Mobilization & Demobilization	$ 294,100
Dredging	$ 232,500
Disposal Site Preparation	$ 265,100
Planning, Engineering & Design	$ 699,700
Construction Management	$ 80,000
Subtotal - GNF	$ 1,571,400
Aids to Navigation	$ 15,600
LERR's for GNF (LERR's)	
Lands & Damages	$ 145,300
Administrative Costs	$ 51,700
Subtotal - LERR's	$ 197,000
Local Service Facility (LSF)	
Lands	$ 15,000
Construction	$ 30,400
Subtotal - LSF	$ 45,400
TOTAL PROJECT COST	**$ 1,829,400**
Non-Federal Cost	
10% GNF During Construction	$ 157,140
10% GNF After Construction	$ 157,140
Credit for LERR's	$ (157,140)
Local Service Facility	$ 45,400
Subtotal - Non-Federal Cost-Share	$ 202,540
LERR's	$ 197,000
TOTAL NON-FEDERAL COST	**$ 399,540**
TOTAL FEDERAL COST	**$ 1,429,860**

5.6.4.2 Fully-Funded Cost Estimate

The current fully funded cost estimate for the selected plan, inflated to mid-point of construction (November 1999) would be approximately the same as the present estimate.

5.6.4.3 Non-Federal Cost Sharing

Although the Crescent City Harbor Project was authorized in 1965, the section of the project presently under study did not have a contract for physical construction awarded before 17 November 1986 (EP 1165-2-1). Therefore, the cost sharing guidelines of Water Resources Development Act (WRDA) of 1986 as amended by WRDA 1996 apply. Title I-Cost Sharing, Section 101. Harbors as amended states in part:

"(a) Construction:

(1) Payments During Construction.--The non-Federal interests for a navigation project for a harbor or inland harbor, or any separable element thereof, on which a contract for physical construction has not been awarded before the date of enactment of this Act shall pay, during the period of construction of the project, the following costs associated with general navigation features:

(A) 10 percent of the cost of construction of the portion of the project which has a depth not in excess of 20 feet;

(2) Additional 10 Percent Payment Over 30 Years.--The non-Federal interests for a project to which paragraph (1) applies shall pay an additional 10 percent of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, at an interest rate determined pursuant to section 106. The value of lands, easements, rights-of-way, and relocations provided under paragraph (3) shall be credited toward the payment required under this paragraph."

(3) Lands, Easements, And Rights-Of-Way. – The non-Federal interests for a project to which paragraph (1) applies shall provide the lands, easements, right-of-way, and relocations (other than utility relocations under paragraph (4), necessary for the project including any lands, easement, right-of-away, and relocations (other than utility relocations accomplished under paragraph (4)) that are necessary for the dredged material disposal facilities.

(5) Dredged Material Disposal Facilities For Project Construction. – In this subsection, the term "general navigation features" includes constructed land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction and for which a contract for construction has not been awarded on or before the date of enactment of this paragraph.

(b) Operation and Maintenance.

(2) Dredged Material Disposal Facilities. – The Federal share of the cost of constructing land-based and aquatic dredged material disposal facilities that are necessary

for the disposal of dredged material required for operation and maintenance of a project and for which a contract for construction has not been awarded on or before the date of enactment of this paragraph shall be determined in accordance with subsection (a). The Federal share of operating and maintaining such facilities shall be determined in accordance with paragraph (1)."

5.6.4.4 Cost Allocation

Table 5.4 shows the major items and total project cost and separates the Federal and non-Federal cost allocations. The Real Estate costs are shown as item of non-Federal costs toward the total cost of the project. Under the cost sharing procedure, the lands, easements, rights of way and relocations (LERR's) are credited against the payment process after construction. The amount of LERR's credited can not be greater than the after construction payment amount.

5.6.4.5 Harbor District Facility

The Harbor District has a local service facility, which the harbor is required to dredge at their expense to facilitate the Federal selected project. Table 5.3, page 25, shows the Harbor District's cost of dredging the channel next to Citizen's Dock would be $45,400. Table 5.4, page 26, shows the cost sharing distribution for Federal and non-Federal costs.

5.7 Real Estate Requirements

The real estate requirements for the Crescent City Harbor Project consist of a temporary work area easement for an upland dredged material disposal site (consisting of 311,018 SF), a temporary pipeline easement for transporting the material to the disposal site (consisting of 16,553 SF), a temporary work area easement for a staging area (consisting of 46,174 SF), and a temporary road easement, if required, for hauling rock dredged material (consisting of 56,628 SF). These areas are all on sponsor-owned property and thus the sponsor will not have to acquire any land rights for this project. The standard estates for the pipeline and road are a permanent pipeline easement and a permanent road easement; and the Corps is requesting approval of temporary easements (one year) for these. The one-year temporary easements are determined adequate for the construction, operation, and maintenance of the project. This determination was made upon assurances from the San Francisco District that the disposal of the dredged material for the project will require no more than one year for placement of material at the proposed disposal site. This is validated elsewhere in the main report, along with providing a Plan of Action for the new ocean disposal site where the future O&M material will be placed. Any change in the project plan formulation that would indicate a use for longer than one year or uncertainty as to the acquisition of an ocean disposal site for O&M, would demand a real estate requirement of the standard estate of fee and permanent easements. In such a case, the increased costs for the permanent land interests would make this project economically unjustified. The sponsor will provide the Federal Government with an executed Authorization for Entry to allow the Government's contractor to enter upon their lands. The Authorization for Entry will be provided prior to the advertisement for construction. There are no utility relocations expected for

the improvement of the upland disposal site or the dredging operation. The Real Estate Analysis is in Appendix C.

5.8 Environmental Impacts

5.8.1 Environmental Assessment

The Environmental Assessment (EA) presents the project's environmental effects in detail. The primary effects are short-term dredging and dredged material disposal impacts. The selected plan's compliance with environmental requirements is also addressed in the EA. The Finding of No Significant Impact (FONSI) is included at the conclusion of the EA.

5.8.2 Cultural Resources

A literature, maps, and records search was conducted at the Northwest Information Center, Sonoma State University, Rohnert Park, California, to assess whether the proposed project would effect significant cultural resources. The search included the National Register of Historic Places, California Inventory of Historic Resources, California Historical Landmarks, the State Lands Commission Database for submerged records, and maps of recorded prehistoric and historic sites. No archaeological or historical resources eligible for the National Register were identified within the APE, which consists of the shipping channels and the Harbor District's upland disposal site. Therefore, dredging and disposal to deepen the Crescent City would have no effect on significant cultural resources.

Based on the history of repeated dredging activities and navigation improvements in Crescent City Harbor, the Corps of Engineers has determined that the potential for finding submerged resources with integrity is very low. Therefore, an additional cultural resources investigation is not warranted at this time. In the event that submerged or buried cultural material is discovered during construction activity (e.g. wood, shell, stone, metal, human remains, etc.) work within the vicinity of the find should immediately cease until a qualified archaeologist evaluates the material and the recommended actions are taken.

Consultation was conducted with The State Historic Preservation Officer in December 1996. Concurrence with our findings, that there are no historic properties that will be affected by the Crescent City Harbor Navigation Improvements project, were received January 1997.

5.8.3 Air Quality

Long-Term Air Quality Impacts - The deepening and expansion of the Crescent City Harbor Access Channel is not expected to increase the number or change the kinds of vessels using the harbor, nor is it expected to attract new industry or other air pollution sources into the harbor area. Completion of the project will reduce delays, which some deeper draft vessels currently experience at low tide. Inasmuch as the deepening project is not expected to bring about any appreciable increase in harbor traffic, or induce growth, which could cause secondary traffic or pollution in the area, the selected alternative would have no long-term air quality impacts.

Summary - The proposed disposal site renovation and the dredging operations would each individually result in 24-hr peak emissions, which would exceed the North Coast Unified Air Quality Management District (NCUAQMD) threshold for significance for NO_x. The main sources of NO_x would be the hydraulic dredge, dozers, a survey boat and a tugboat. These temporary emissions would last only for the 45 days for the disposal site re-construction and for an additional eleven days for dredging operations. Neither worst-case emissions scenario for peak 24-hr emissions is likely to occur during project operations. It is unlikely that the proposed project would bring about a violation of the state ambient air quality standard for nitrogen dioxide or for the state or federal ozone standard. Ambient air quality levels would quickly return back to the pre-project levels in the harbor area and would not be expected to have adverse health effects on any receptors. The proposed disposal site renovation and dredging activity would therefore not likely have a significant long-term or short-term impact on air quality. See Appendix C in the Environmental Assessment following the GRR.

5.9 Mitigation Plans/Other Commitments

In accordance with paragraph 7-35 of Engineering Regulation 1105-2-100, the planning of Corps projects must ensure that project caused adverse impacts to fish and wildlife resources have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. The recommended plan must contain sufficient mitigation to ensure the plan selected will not have more than negligible net (including mitigation) adverse impacts on fish and wildlife resources.

Justification of mitigation features recommended in projects is based upon consideration of the monetary and non-monetary values of the last added increment of losses prevented, reduced, or replaced, which must be at least equal to the combined monetary and non-monetary costs of the last added increment, so as to reasonably maximize overall project benefits.

The Coordination Act Report prepared by the U.S. Fish and Wildlife Service (FWS) does not recommend any mitigation for impacts of channel construction due to the small area affected by the project. The FWS is withholding any mitigation recommendations for the upland disposal alternative pending verification that permitting of the site will be renewed promptly by the Harbor District. If the permitting is renewed without delay, there will be no additional impact. However, if permitting is delayed, and habitat is allowed to develop at the disposal site, it is likely that the FWS will recommend mitigation.

The FWS recommends in the CAR that project dredging be restricted to a late August to early November time frame to the extent feasible, to best minimize impacts on critical life stages of coho salmon and Klamath Mts. Province steelhead, which use the Crescent City Harbor. It is possible to obtain a waiver for dredging until the beginning of the herring fishing season in January. If the dredging would take place in December, a waiver could be obtained. Maintenance dredging should be restricted to this same "window" as well. In addition, the FWS recommends the upland disposal site be re-surveyed to confirm the absence of the endangered western lily. Mitigation for the western lily would be required only if it is found growing inside the disposal site area during the pre-construction survey, which is very unlikely. The cost of a

field survey in the disposal site would be minimal. Based upon the findings and proposed mitigation measures identified in the Final EA (included), the proposed channel dredging and disposal activity is expected to create only minor and temporary impacts on the surrounding environment. Therefore, it is likely that there will not be significant effects on the quality of the human environment and preparation of an Environmental Impact Statement (EIS) will not be required. For the final phase of this project, coordination will be required with the California Coastal Commission, California State Lands Commission, and North Coast Regional Water Quality Control Board and the Crescent City Harbor District.

5.10 Risk and Uncertainty

The primary risk and uncertainty for the Crescent City Harbor Deepening Project is related to the economic viability for the fishing industry in the north coastal section of California.

According to Ron Warner, Associate Marine Biologist for the California Department of Fish and Game, the amount of fishing undertaken at Crescent City Harbor will be sustained for the next 20 to 50 years, barring unforeseen circumstances, such as disease or changing hydrographic conditions (see Economic Analysis, Appendix B, Figure A). The policy of Fish and Game is to maintain sufficient populations of all species of aquatic organisms. Strict regulations on net size and the length of fishing seasons help maintain fish populations at sustainable levels.

Jim Glock, Marine Biologist for the National Marine Fisheries Service (NMFS) agrees with Warner. NMFS has just completed their annual groundfish management accounts, setting harvest levels and fishing restrictions for 1997. In Glock's words:

> "It is often difficult to predict, due to changes in the number of vessels competing for the resources, changes in the oceanic environment and other factors, the populations of fish. The fishery is expected to remain near current levels, with annual or cyclical variations. Management of whiting has been quite conservative and is based on a relative abundance of scientific information. Rockfish (genus Sebastes) species, including many nearshore species, have been heavily harvested in recent years. Rockfish are typically long-lived with low annual reproductive rates. Thus harvest rates must be kept very low. An analogy might be old growth forest management; when one tree (or fish) is removed, it may take 20 to 30 years or longer for a similar tree/fish to replace it. Available biological data are inadequate to provide very precise estimates of abundance of many rockfish species, and even trends are difficult to discern. A recent assessment of rockfish off the West Coast indicates biologically acceptable harvest levels should be reduced from previous estimates. This may not affect the amount of fish actually harvested, however, because "quotas" have not been achieved. Either the fish have been unavailable, or markets have not provided incentive to harvest them.
>
> "Recently, however, rockfish markets have been developed or improved, especially for fish caught with hook-and-line (HKL) gear rather than trawls. As mentioned previously, vessels using HKL gear are typically smaller than those using trawls. We do not expect increased harvests of these species. They are

likely to decline, perhaps substantially. "Another major fishery in the region is for Dover sole, thorny heads, and sablefish. These three species are taken together by trawlers, while HKL vessels target sablefish almost exclusively. Recent stock assessments have shown general declines in these species, but data

and assessment methods have been the subject of increased controversy. New assessments are planned in 1997."

"Overall, the commercial fishery has been in a process of fishing most stocks down to levels we hope are sustainable over the long term. Thus, recent catch levels are probably better indicators of long term yields, as opposed to using the average of the past 10 or 20 years. Some evidence might show declines in abundance of various species are at least partly due to long term changes in ocean conditions; warm water conditions have prevailed since the mid-1970s. This situation appears to have moderated recently, which would result in cooler water and "friendlier" environment for species that do better in colder water. At this point, this is somewhat speculative, and assuring current levels to continue may be more prudent. The goal of fishery management is to maintain healthy stocks at levels that will support an economically viable fishing industry."

Both State and Federal resource agencies help corroborate the assumption that the economic activity will be sustained and that the fishing industry will not be adversely affected by the deepening of the Crescent City Harbor Channel.

5.11 Plan Implementation

5.11.1 Institutional Requirements

The present project schedule was updated 3 August 1999. The following are key project milestones:

Funded in appropriation act	Nov	1997
Plans and specifications approved	Sep	1999
PCA executed	Sep	1999
Real estate acquisition completed	Oct	1999
HQ approval date new construction	Nov	1999
Construction contract awarded	Dec	1999
Project construction completed	Dec	1999
Final accpt. & trans. project to sponsor	Feb	2000

Upon approval of the GRR, the Corps and the non-federal sponsor would enter into a project cooperation agreement (PCA). The PCA would define the Federal and non-Federal responsibilities for funding, implementing, operating and maintaining the project.

The non-Federal sponsor is also required to pay ten percent during construction and an additional ten percent of the total cost of the general navigation features of the project in cash over a period not to exceed 30 years. The value of lands, easements, rights-of-way, and relocations (LERR's), are credited to this payment. (See Sec. 5.6.4.3)

5.11.2 Division of Responsibilities

The following paragraphs outline additional Federal and non-Federal responsibilities in connection with development of general navigation projects, as mandated by WRDA 1986, Public Law 99-662, and other pertinent laws and policy guidance.

5.11.2.1 Federal Responsibility

The Corps of Engineers would be responsible for preparing detailed plans and specifications necessary to award a contract, and constructing and maintaining the general navigation features resulting from implementation of the selected plan. The selected plan would include construction of the upland disposal site consistent with Sec. 201 of WRDA 96.

5.11.2.2 Non-Federal Responsibilities

Based on guidance contained in ER 1165-2-131, "Local Cooperation Agreements for New Start Construction Projects", non-Federal interests are subject to cost-sharing, financing, and other applicable requirements of Public Law 99-662, and in addition, are subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, and the following requirements:

a. Enter into an agreement, which provides, prior to construction, 25-percent of design costs;

b. Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

c. Provide, during the period of construction, a cash contribution equal to 10 percent of the total cost of construction of the general navigation features, which include any construction of or improvement to land-based or aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the facility's construction or improvement was not awarded on or before October 12, 1996;

d. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;

e. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features

(including all lands, easements, and rights-of-way, and relocations necessary for dredged material disposal facilities).

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities at Crescent City Harbor District; in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;

i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

j. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

k. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

l. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features;

m. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

n. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;"

p. Provide a cash contribution equal to the non-Federal cost share of the project's total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of 1 percent of the total amount authorized to be appropriated for commercial navigation; and

q. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

6. COORDINATION AND PUBLIC INVOLVEMENT

6.1 Public Meetings, Workshops and Report Circulation

The local sponsor for this study is the Crescent City Harbor District. A public workshop was held in March 1989 for Federal and local agencies, and interested parties and individuals. They were invited to give their opinions on the problems and types of solutions being considered. Since the project alternatives have not changed substantially, no public meeting was held following the start of the GRR.

Throughout the course of the study, communication and coordination was maintained with the potential local sponsor, the Crescent City Harbor District, the US Fish and Wildlife Service and with other interested groups and individuals. Several site visits, informal meetings, and numerous phone conversations were used to gather general and specific information required to develop the different project alternatives.

6.2 General Reevaluation Report (GRR) Public Involvement

Coordination with and participation by the local sponsor, the Crescent City Harbor District, the US Fish and Wildlife Service and others will continue during the PED phase through approval of the Final GRR. Public involvement will include public notices to ensure full public disclosure as required under the National Environmental Policy Act (NEPA). This will allow the public to voice their concerns about the Final Environmental Assessment and Draft Finding of No Significant Impact, which are included in this document.

6.3 Circulation of the GRR

The Draft Environmental Assessment was circulated during July 1999 for comments to a wide range of federal, state, and local agencies to include the following:

a. Federal

Department of the Interior, Office of Environmental Review
Environmental Protection Agency, Region 9
Fish and Wildlife Service
Department of Commerce, National Marine Fisheries Service
Coast Guard

b. State of California

Department of Fish and Game
California Coastal Commission
Regional Water Quality Control Board
Air Resources Board
State Historic Preservation Officer

c. Local

Del Norte County
City of Crescent City
Crescent City Harbor District

The Final GRR and EA will have limited circulation. Groups receiving the Final GRR include the U.S. Army Corps of Engineers, San Francisco District Quality Control (QC), Independent Technical Review Team; U.S. Army Corps of Engineers, South Pacific Division; HQUSACE and the Crescent City Harbor District.

6.4 Views of the Local Sponsor

The Harbor District believes there is a need to provide a channel with a consistent depth from the Small Boat Basin to the deeper Federally-maintained Inner Harbor Channel to eliminate tidal delays, safely accommodate larger vessels, and increase the efficiency of the harbor. The Harbor District is seeking Federal assistance to deepen and maintain the channel to adequate depths.

7. CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this General Reevaluation Report is that an economically feasible solution to the navigation problem exists. This solution involves implementing the NED Plan, which consists of deepening the access channel to -14 feet MLLW plus one-foot of advanced maintenance. The estimated project first cost is $1,829,000 (1999 price level), and the estimated benefit-to-cost ratio is 2.6 to 1. The total annual benefit is $374,800 and net annual benefit for the selected plan is $232,200 and the annual cost is $142,600.

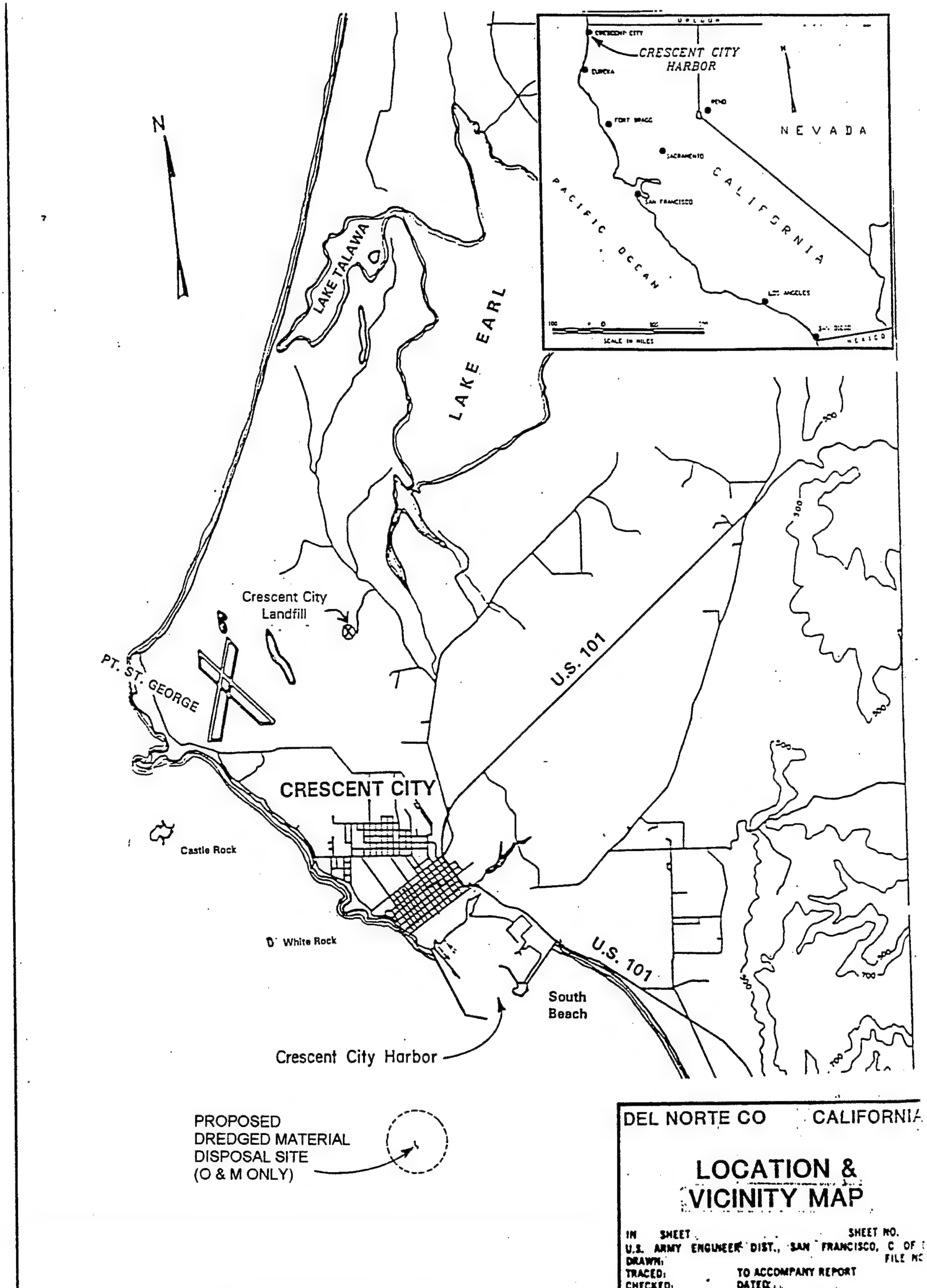
The conclusion of the Environmental Assessment is that an Environmental Impact Statement is not required. A Finding of No Significant Impact was signed on 9/3/99.

The General Reevaluation Report recommends implementation of the NED Plan under the existing authority of Section 301 of the Rivers and Harbors Act of 1965. This document fully responds to the study authority as defined by the Corps' planning process and attendant planning policies.

"The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress ad proposals for authorization and implemented funding." However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further. (ER1105-2-100, Chap. 2, par. 2-12k)

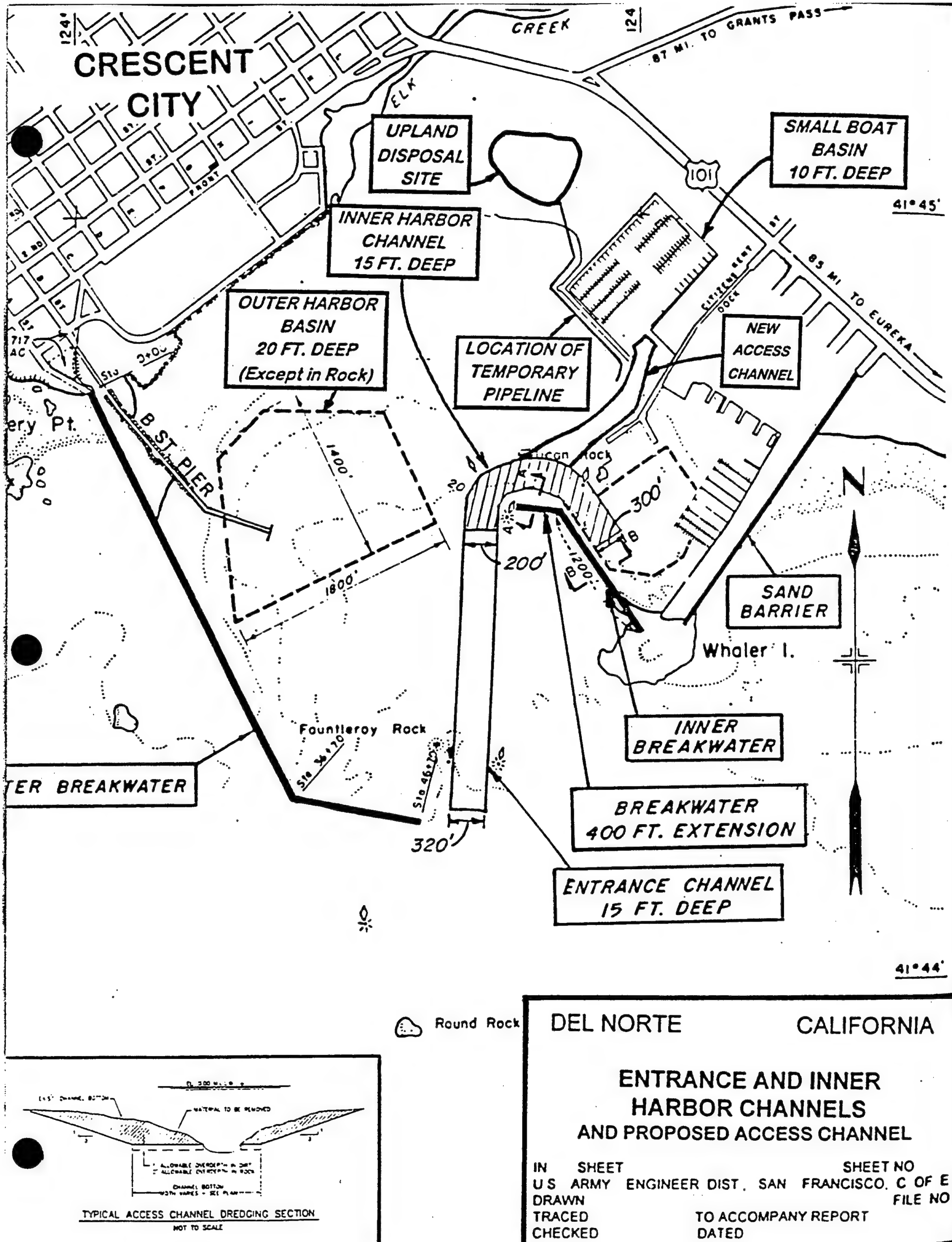
9.3.99
Date

Peter T. Grass
Lieutenant Colonel, Corps of Engineers
District Engineer



CRESCENT CITY HARBOR
NEVADA
CALIFORNIA
PACIFIC OCEAN
N
LAKE TALAWA
LAKE EARL
Crescent City Landfill
PT. ST. GEORGE
U.S. 101
CRESCENT CITY
Castle Rock
White Rock
U.S. 101
South Beach
Crescent City Harbor
PROPOSED DREDGED MATERIAL DISPOSAL SITE (O & M ONLY)
DEL NORTE CO CALIFORNIA
LOCATION & VICINITY MAP
IN SHEET SHEET NO.
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF
DRAWN: FILE NO
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED

PLATE 1

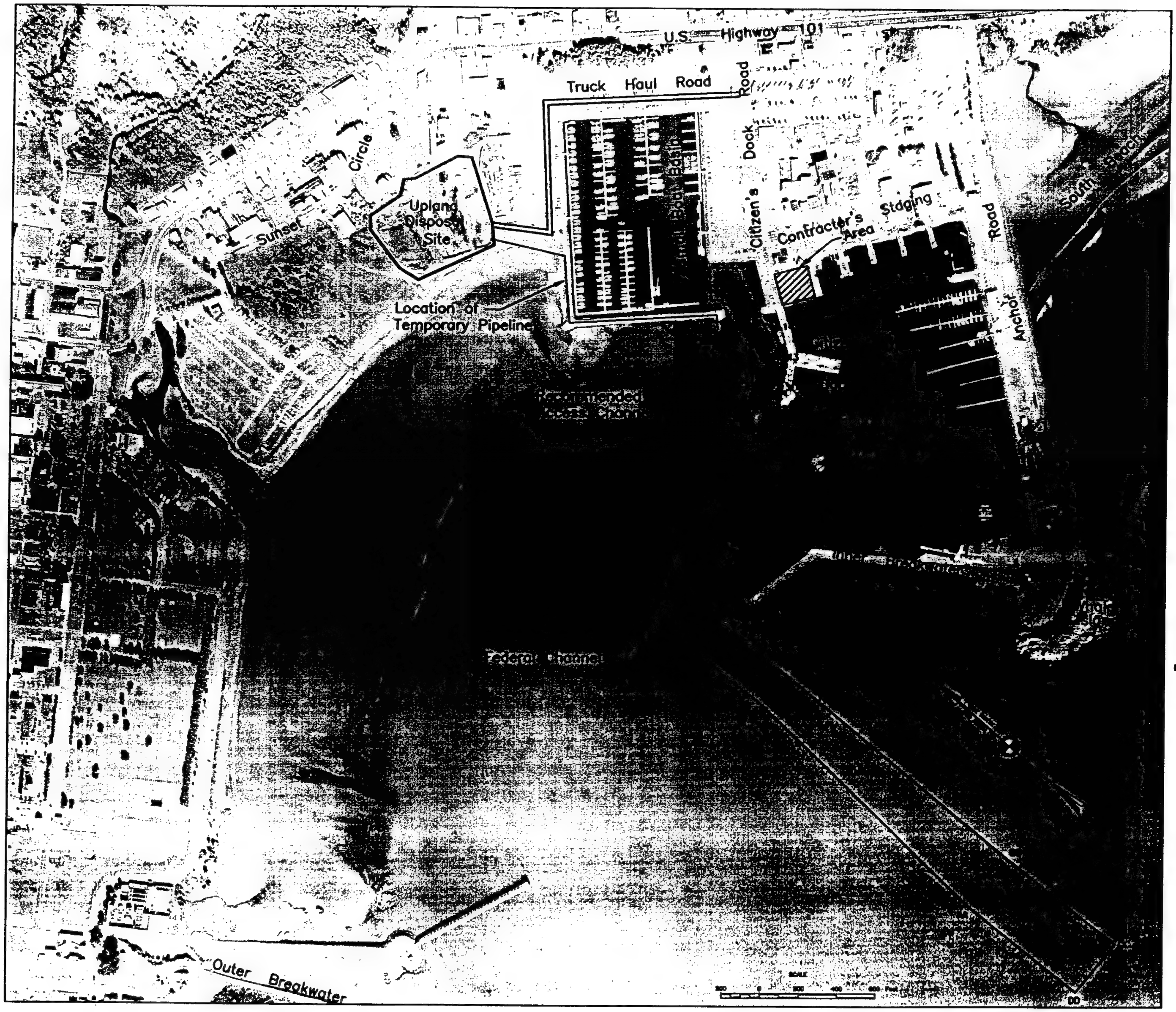


DEL NORTE CALIFORNIA

ENTRANCE AND INNER HARBOR CHANNELS AND PROPOSED ACCESS CHANNEL

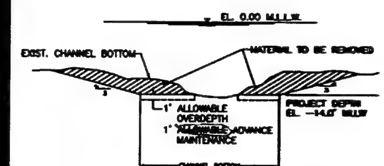
IN SHEET SHEET NO
U S ARMY ENGINEER DIST. SAN FRANCISCO. C OF E
DRAWN FILE NO
TRACED TO ACCOMPANY REPORT
CHECKED DATED

PLATE 2



RECOMMENDED CHANNEL POINTS		
POINT	NORTH	EAST
1	886,007.92	1,403,284 28
2	886,049.00	1,403,540 21
3	886,303.10	1,403,984.37
4	886,434.00	1,404,110.31
5	886,669.85	1,404,210 44
6	886,711.00	1,404,177.00
7	886,828.00	1,404,300.00
8	886,723.00	1,404,385.00
9	886,429.38	1,404,260.61
10	886,258.40	1,404,188.17
11	886,135.40	1,403,973.17
12	886,092.00	1,403,998.00
13	886,215.00	1,404,213.00
14	886,341.00	1,404,302.00

FEDERAL CHANNEL POINTS		
POINT	NORTH	EAST
A	885,320.00	1,404,100.00
B	885,907.50	1,403,719.25
C	886,037.97	1,403,154.12
D	885,940.16	1,402,934.90
E	885,623.01	1,402,744.40
F	885,173.16	1,402,755.60
G	885,173.16	1,402,955.60
H	885,569.54	1,402,945.78
I	885,783.11	1,403,073.85
J	885,828.05	1,403,174.33
K	885,762.63	1,403,455.34
L	885,467.45	1,403,647.06
M	885,156.92	1,403,848.20
N	885,181.10	1,403,890.17
O	885,491.63	1,403,689.03
AA	883,637.04	1,402,880.10
BB	883,645.00	1,402980.00
CC	882,945.22	1,402,997.42
DD	882,937.25	1,402,677.52



TYPICAL ACCESS CHANNEL DREDGING SECTION

N.T.S.

US Army Corps of Engineers San Francisco District

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HABOR GRR

LOCATION OF PROPOSED ACCESS CHANNEL AND UPLAND DISPOSAL SITE

DRAWN BY: S. D.

PREPARED UNDER THE DIRECTION OF RICHARD G. THOMPSON LT. COLONEL, C.E., DISTRICT ENGINEER

PLATE 3

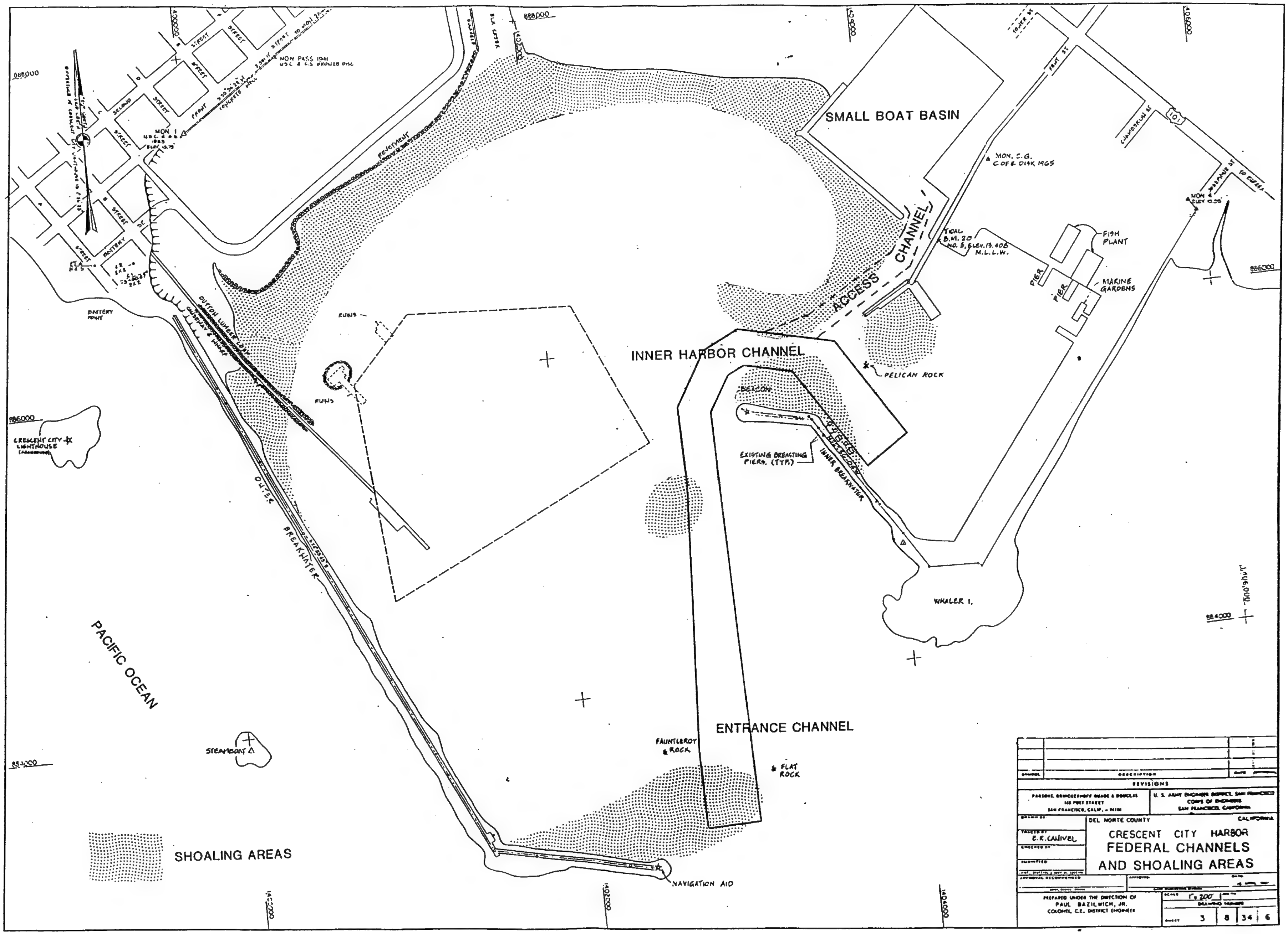

SMALL BOAT BASIN
ACCESS CHANNEL
INNER HARBOR CHANNEL
ENTRANCE CHANNEL
PACIFIC OCEAN
SHOALING AREAS
OUTER BREAKWATER
INNER BREAKWATER
EXISTING BREASTING PIERS (TYP.)
BEACON
PELICAN ROCK
WHALER I.
FAUNTLEROY ROCK
FLAT ROCK
NAVIGATION AID
STEAMBOAT
CRESCENT CITY LIGHTHOUSE
BATTERY POINT
RUINS
PIER
FISH PLANT
MARINE GARDENS
MON. S.G. C OF E DISK 1965
TIDAL B.M. 20 NO. 5, ELEV. 13.406 M.L.L.W.
MON PASS 1941 USC & GS BRONZE DISC
DUTTON LUMBER CO.
REVETMENT
101
FRONT ST.
DEL NORTE COUNTY
CALIFORNIA
CRESCENT CITY HARBOR
FEDERAL CHANNELS AND SHOALING AREAS
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
E.R. CANIVEL
PREPARED UNDER THE DIRECTION OF PAUL BAZILWICH, JR. COLONEL, C.E. DISTRICT ENGINEER
1" = 300'
3 8 34 6

PLATE 4

APPENDIX A

ENGINEERING ANALYSIS

CRESCENT CITY HARBOR
ENGINEERING ANALYSIS

TABLE OF CONTENTS

TABLES

PLATES

ATTACHMENTS

CRESCENT CITY HARBOR
ENGINEERING ANALYSIS

1. GENERAL – SELECTED (NED) PLAN

This Engineering Analysis considers the amount and type of traffic which will be using the waterway, commodities moved, safety, efficiency, reliability, and cost in the development of an access channel from the Federal Inner harbor to Citizen's Dock and the Small Boat Marina in the Crescent City Harbor.

1.1 Selected Plan

The plan of improvement for this project is dredging an access channel from the existing Federal channel to the entrance of the Small Boat Basin. (See Plate 1). The NED (National Economic Development) plan is a channel at -14 feet MLLW (Mean Lower Low Water), plus one-foot of advanced maintenance and one-foot of allowable overdepth. The advanced maintenance would provide shoaling space for a five-year operation and maintenance (O&M) cycle. The proposed channel would extend from the present Federally maintained Inner Harbor Channel to the Small Boat Basin. The approximate length of the access channel is 1,200 lineal feet. The bottom width of the channel dredging varies from a minimum of 140 feet to a maximum of 210 feet near the existing Federal channel. The additional width would facilitate the navigation of the turn from the Federal channel. The access channel will be wider at Citizen's Dock, the dredging will extend to the northwest side of the Dock, the berthing areas. This would be a non-Federal cost as this will be added at the request of the local sponsor, the Crescent City Harbor District. This area is outlined by points 9, 10, 11, 12, 13, and 14 on Plate 1. This will allow boats to navigate adjacent to the dock through a deeper channel. The turn at the boat basin will be as wide as possible. The existing levees of the boat basin restrict the width of the channel at the entrance. The excavated channel side slopes will be 1 vertical on 3 horizontal. A typical cross section of the channel dredging is shown on Plate 1. A dredge connected to the present pipeline would place dredged material into the Harbor District's Upland Disposal Site.

1.2 Operation and Maintenance (O&M).

The first O&M dredging would be expected five years after project construction. The present two Federal Channels and the proposed project channel would be combined into one operation producing an estimated average quantity of 76,000CY of O&M dredged material every five years. The primary disposal location would be a newly designated ocean site. The Whaler Island beach nourishment site could be available for qualifying sand material from the Entrance Channel and the other channels. An action plan to designate an ocean disposal site is underway.

2. NAVIGATION CONSIDERATIONS

2.1 Tides

Tides in the Crescent City Harbor area are characterized by the diurnal inequality common to the Pacific Coast, with a difference of several feet between the two high tides and two low tides in a 24-hour period. The mean diurnal range of tide is 6.9 feet, and the extreme range is 12.9 feet (2.9 feet below MLLW to 10.0 feet above MLLW). Tides below datum occur twice each month for several days in succession. Water levels for Crescent City Harbor are presented in Table 5.1 below.

Table 2.1 Water Levels for Crescent City Harbor.

Extreme High Water	10.0 feet
Mean Higher High Water (MHHW)	6.9 feet
Mean High Water (MHW)	6.3 feet
Mean Tide Level (MTL)	3.8 feet
Mean Sea Level (MSL)	3.6 feet
Mean Low Water (MLW)	1.2 feet
Mean Lower Low Water (MLLW)	0.0 feet
Extreme Low Water	-2.9 feet

2.2 Currents

Currents within Crescent City Harbor are predominantly tidally-influenced, and occur as the water level in the harbor rises and falls. Currents can also be wind-induced, when strong winds cause surface waters to flow in the direction of the wind. Although measured current data within the harbor are not available, current velocities within Crescent City Harbor are suspected to be weak, due to the sheltered nature of the harbor. Currents have not been a problem to fishing vessels, and significant changes to existing current patterns or velocities are not expected as a result of the proposed project.

2.3 Waves

The coast of northern California is subject to severe winter storm waves that generate waves from the northwest to the south directions. The prevailing winds in the summer and the fall are from the north and northwest. Since the outer breakwater at Crescent City effectively protects

the harbor from waves from the west to northwest, the critical waves are from the south and west-southwest. The Inner breakwater and the 400-foot-long extension also provide wave protection to the Small Boat Basin and Citizen's Dock.

Measured wave data within the harbor are not available. Physical model studies used to optimize the design of the inner breakwater extension showed that the outer and inner breakwaters considerably attenuated the severe offshore wave conditions. The current navigation problems are not attributed to the wave conditions in the harbor, and deepening the access channel will not change wave conditions.

2.4 Harbor Sediments

Sediment Physical Properties -- Sediments previously dredged in the inner harbor area have been silty sands with a few organics. Cobbles and gravel, which may be the remnants of an old river bed, have been encountered in previous maintenance dredging, according to harbor personnel. The most recent samples obtained in September 1996, were comprised of dark gray sands containing organic material ranging from fine grained to medium and loose, to dense medium grained sands. See Plate 2 for the logs of the 1996 exploration.

Sediment Sources -- A littoral transport study by Roberts (1970) identified four possible sources of sediment material in Crescent City Harbor. These sources were Elk Creek (which empties into Crescent City Harbor), aeolian (windblown) material, redeposition of dredged material, and littoral transport of beach sands. Of these four possible sources, littoral transport was identified as the only source with significant potential to deposit sediment. However, no predominant direction of sediment transport could be identified, and the study suggested that material is moving into the harbor from both north and south directions.

2.5 Littoral Transport

During summer months, storms are infrequent and wave action in the harbor vicinity is moderate. During winter months, the area is subjected to severe wave action, and waves in excess of 25 feet occur in the immediate harbor vicinity. The outer breakwater protects the outer harbor from west- and northwest-approaching waves and provides partial protection from southwesterly winter storm waves. The outer and inner breakwaters together provide almost complete surface wave protection to the inner harbor basin. However, these breakwaters do not completely prevent wave-generated sand transport into the harbor.

Littoral drift in the Crescent City Harbor region is generally from the north. The primary sediment source north of Crescent City is the Smith River, and a broad beach with sand dunes extends southward from this source. Sediment is transported from the mouth of the Smith River, which is 9 miles south to Point St. George. However, beach sand south of Point St. George is of local origin, indicating that most southward-moving sediment from the Smith River basin is lost to deep water by the time it reaches Point St. George. Deep water sediments could move into the harbor during northwesterly, southwesterly, or southerly wave conditions, or around the harbor and on to South Beach or more southerly beaches.

Littoral transport along South Beach (located directly south of Crescent City Harbor) is primarily controlled by the angle of wave incidence, with sediment sometimes being transported north toward Crescent City by an eddy current of the prevailing southerly coastal currents. Also, local wind-driven currents may contribute to northward littoral drift patterns.

2.6 Rock Outcrops

The bottom materials in the project area are expected to be predominantly sands and silts. One concern is that there could be rock outcrops that could make dredging difficult. A 1970 geophysical hydrographic survey of the area showed potential rock outcropping in the channel alignment as shallow as -12 feet MLLW. However, this survey was taken before the Harbor District constructed the Small Boat Basin, which included dredging the 150-foot-wide access channel down to -16 feet MLLW. A Corps of Engineers hydro-survey conducted in 1993 and a sample point survey shows that rock in the access channel was at -15 feet MLLW.

2.7 Harbor Shoaling

Bathymetric Surveys – Based on a comparison of bathymetric surveys for Crescent City Harbor from 1993, 1995, and 1998, it was determined that over the last five years that the average shoaling rate within the Small Boat Basin Access channel was two-tenths (.2) of a foot per year.

Methodologies – An analysis utilizing two separate methodologies was conducted to estimate the expected rate of shoaling upon completion of the deepening project. It was found that the shoaling rate should not increase significantly. To account for limitations in the analysis, a conservative increase of two-tenths (.2) of a foot per year should be used, leading to an overall shoaling rate of four-tenths (.4) of a foot per year. This value represents the upper bound of the expected post project, shoaling rate. A doubling of a channel's shoaling rate after deepening rarely, if ever, occurs. The detailed analyses are in Attachment A-1.

Current Condition – Ideally a larger study that would have included wave energy, tidal currents, sediment loads, and numerical modeling could have been performed. However, it is understood that due to time and cost restraints this option was not available. Working with the limited resources available, the problem was looked at using very basic analytic tools.

Using available bathymetries from 1993, 1995, and 1998 the shoaling rates over the last five years were determined. Although a longer record would be better these bathymetries provided a fair base. In this analysis (A-1, Attachment 2) it was found that the average shoaling rate over the last five years along the channel was two-tenths (0.2) of a foot per year, with a standard deviation of one-tenth (.1) of a foot. As the standard deviation suggests, the shoaling rate was fairly uniform over the study area. The highest rate of accretion was found to be seven-tenths (.7) of a foot per year between 1995 and 1998 near the entrance to the Small Boat Basin. The information from the surveys shows that the current shoaling rate is significantly lower than the predicted one (1) foot per year.

Post Project Condition – The rate of shoaling in a particular area depends upon hydrodynamic characteristics and sediment load in the water column. A change of either of these components will result in a change in shoaling rate. Changing the configuration of a navigation channel will almost certainly change the local hydrodynamics and sometimes change the sediment load quantities.

The survey information on its own suggests that shoaling will not increase significantly in the channel once it is deepened. The proposed increase in depth of three (3) feet should not cause significant changes in the hydrodynamic characteristics of the area. To support this opinion the Conservation of Sediment Equation (Equation) and the Shoaling Rate Equation (Equation 18) were used. The use of the Conservation of Sediment Equation was made difficult by the lack of available data such as such as, current velocities and directions, sediment load, bed load, falling velocities, etc. To compensate for the lack of information several assumptions were made.

Conclusions – Due to the relatively small change in depth, of an already existing natural channel, any expected increase in shoaling would be small. Using two basic methods, the expected shoaling rate increase was estimated. Both methods showed that the increase should be small. Considering the level of accuracy of the calculations, and the assumptions that were made, a safety factor was added to the calculated results leading to a four-tenths (.4) of a foot per year shoaling rate. This value represents a doubling of the exiting shoaling rate. An increase of this magnitude rarely, if ever occurs after a deepening project. This is an average for the entire channel, and does not account for "hot spots". As shown in the past bathymetries, certain areas are more susceptible to shoaling. These areas may shoal several times faster than the rest of the channel. It is impossible to determine if and where these spots will occur without a more detailed study. See ATTACHMENT 1, "MEMORANDUM FOR CESPN-PE, ATTN: Gary Flickinger, SUBJECT: Crescent City Shoaling Rate Investigation."

2.8 Dredging History

Dredging has occurred at Crescent City Harbor since FY1936. The dredging cycle has ranged from annual the first four years to five years since FY1956. The quantities dredged range from 16,353 to 187,372 cubic yards.

3. SURVEYING

3.1 Depth Survey

See ATTACHMENT 2, "SUBSURFACE GEOTECHNICAL INVESTICATION: REPORT OF FIELD ACTIVITIES" and Sub-section 4.2 below.

3.2 Physical Properties Survey

See ATTACHMENT 3, Letter dated November 1, 1996, From the SPD Laboratory with the table of "Soil Test Result Summary" included and Sub-section 4.2 below.

3.3 Environmental Survey

See ATTACHMENT 4, Seafloor Characterization Study, December 1996

4. GEOTECHNICAL

4.1 Regional Site Geology

The bedrock underlying Crescent City Harbor is Jurassic-Cretaceous Franciscan Complex. The Franciscan Complex is composed of soft to moderately hard, highly sheared to closely fractured shale with irregular masses, pods, and lenses of highly fractured, moderately hard graywacke (a type of sandstone). Occasionally some harder, moderately to highly fracture sandstone and some greenstone (metavolcanic rock) may be found. Whaler Island, located within Crescent City Harbor consists mostly of greenstone although graywacke containing volcanic sediments and some chert have also been found. Rock pinnacles exist or are known to have existed within the inner harbor area. For example, Pelican Rock and the rock on which the southern leg of the "Y" at the end of Citizens Dock is founded. Bedrock material is expected to be similar to that which was found in rock-core borings 1F-9 through 1F-17 drilled in the Inner Harbor Channel during May 1980, and found in wash boring probe P-22, P-15, P-14, and P-63. The wash boring probes were performed in 1926. Probe P-22 is located in the entrance channel area and probes P-15, 14, and 63 are located in the surrounding adjacent area of the proposed deepening.

Geophysical explorations, performed by Crawford Marine Specialist Inc. in July 1970 indicate that the bedrock surface should be expected to be irregular with rounded knobs and irregular shaped pot-holes and shallow depressions. In the reach of the proposed channel alignment inland from the end of Citizens Dock, the bedrock surface may range from -4.57 meters MLLW to as shallow as 3.66 meters MLLW. Close to the Crescent City Inner Harbor Channel the bedrock may range from as shallow as -3.96 meters MLLW to as deep as -5.49 meters MLLW. In January 1983, geophysical work was performed along the southern portion of the Inner Harbor Channel in preparation to deepen the channel. Geo-Recon International Ltd. performed the work for Towill Incorporated under contract to the San Francisco District, Corps of Engineers. According to the results of the survey, the bedrock can be expected to have primary seismic refraction wave velocities of 1,650 to 2,100 meters per second for the soft to moderately hard shale and moderately hard sandstone, and 2,250 to 3,320 meters per second for the harder rock.

4.2 Subsurface Investigations and Soils Testing

Drilling. Five (5) borings were drilled at the locations shown on Figure 2, Attachment 2, Report of Field Activities from 17 September to 18 September 1996 in Crescent City Harbor. The depth of the soil borings ranged from 1.5 to 14.4 feet below the harbor bottom. A barge-mounted Diedrich D-25 rotary drilling rig was used with a water pump mounted on the barge for circulating fluid (seawater) through the four-inch hollow drill pipe during drilling.

Sampling. Soil samples were obtained continuously and shared with Battelle (for quantitative chemical analysis). Samples were obtained using the Standard Penetration, SPT, sampler (the 3-inch and 2-inch split-spoon sampler). The SPT was performed in accordance with ASTM standard method designation D 1586-84.

The sampler was driven 18 inches by a 140 pound hammer with a 30-inch fall. The blows to drive the sampler the last 12 inches were recorded on the boring logs. The samples were sealed, protected, stored and prepared for shipment in accordance with ASTM standard D 4220-83.

Laboratory Soil Testing. Soil samples were delivered to the San Francisco District Laboratory for further classification and testing. Testing consisted of mechanical analyses, density, and visual classification of material. Results of laboratory testing are shown on the Boring Log (Plate 2) and in the Soil Test Result Summary (Attachment 3).

Entrance Channel to Small Boat Basin. Bedrock surface in the channel area is expected to be irregular with rounded knobs, and irregularly shaped pot-holes, and shallow depressions. In the reach of the channel inland from Citizen's Dock, the bedrock surface may range from an elevation -16 feet MLLW to as shallow as -12 feet MLLW with occasional depressions deeper than -16 feet MLLW. The reach from Citizen's Dock to 200 feet toward the Inner Harbor Channel is expected to have a bedrock surface that may range from -18 feet MLLW to as shallow as -14 feet MLLW with occasional irregular knobs that may have tops as shallow as -13 feet MLLW and depressions deeper than -18 feet MLLW. The next reach, which junctions with the Inner Harbor Channel, may have a bedrock surface that ranges from -22 feet MLLW to -18 feet MLLW and may have an occasional irregular knob with a top elevation as shallow as -14 feet MLLW. Data is from results of a sub-bottom survey conducted by Crawford Marine Specialists Inc. of San Francisco in July of 1970.

For estimating purposes, rock is assumed to occur below -15 feet MLLW. The rock consists of fractured sandstone that could be excavated without blasting. This assumption is based on the September 1996 sediment survey within the general area of the proposed access channel.

Analyses Borings CC-1 through CC-5 indicates the material overlying the bedrock is loose to medium dense sand with varying amounts of shale, silt, gravel, shell fragments, and organic materials. High content of organics were found in sediment samples taken from the Inner Harbor Channel on the north side of the Inner Breakwater in early FY 88. The thickness of sand to be dredged may range from 4 feet to 10 feet.

The side slopes excavated into bedrock should be stable at a 1 horizontal to 1 vertical slope. The maximum height of the rock slope is not expected to exceed approximately 4 feet, assuming a finished bottom elevation of -18 feet MLLW. However, as the thickness of the overlying loose sand will be variable and may range up to 10 feet, it is recommended that the side slopes be excavated at a 3 horizontal to 1 vertical slope.

4.3 Seismicity

Crescent City and harbor rest on the leading edge of the North American continental plate, approximately 84 kilometers from the surface trace of the Cascadia Subduction Zone (CSZ) where the remnants of the Farallon oceanic plate is being subducted (thrust under) beneath the North American plate at a rate of approximately 40 millimeters per year. Three remnants of the Farallon plate are actively being subducted along the 1,200 - kilometer length of the CSZ. The remnants are the Gorda plate, Juan de Fuca plate, and the small Explorer plate at the far northern end. The CSZ extends northwesterly from the Mendocino fracture zone at Cape Mendocino, Humboldt County, California, to the Queen Charlotte fault transform plate boundary offshore of British Columbia, Canada. The Gorda plate is being subducted along a 241-kilometer length, which forms the southern reach or segment of the CMZ. The boundary between the Gorda plate and the Juan de Fuca plate to the northwest is Blanco fracture zone. The Blanco fracture zone offsets the spreading ridge of the East Pacific Rise by several hundred kilometers. The Blanco fracture is projected to cross the coastline beneath the continental plate at Cape Blanco along the southern coast of Oregon. The interface between the subducting Gorda plate and the North American plate lies approximately 20 kilometers below Crescent City.

The CSZ is believed to be able to produce a maximum credible earthquake of M 9.5 based upon paleoseismicity studies and the magnitude of other subduction zones. A earthquake of M 9.5 would occur if the total length of the CSZ were to rupture as one event. However, it is thought that it may be more reasonable to assume that the rupture of the CSZ may occur along segments created by each of the remnant plates. Although little is known about the possible independent seismic activity of the Gorda plate segment, a maximum credible earthquake of M 8.4 has been assigned to it by Toppozada and others (1995) in a planning scenario developed by the California Division of Mines and Geology.

Paleoseismicty studies have resulted in an estimated recurrence interval of a very great, M 9+, earthquake to be 300 to 600 years; the last event to have occurred approximately 300 years ago. Curiously enough, a recent study of historical records of Tsunamis that have hit the Islands of Japan has revealed that on 26 January 1700, a Tsunami hit Japan, coming from the direction of the CSZ along the Pacific Northwest of North America. The size of the Tsunami wave suggests a M 9 event meaning that the whole CSZ may have ruptured. This bit of research supports the results from the paleoseismicity studies.

If one assumes that the Gorda segment of the CSZ could rupture independently, generating a M 8.4 earthquake, Crescent City would incur extensive Tsunami damage as well as very strong ground shaking, modified Mercalli intensity of eight plus (MM VIII+) for up to 60 seconds of duration (Toppozada, T., et al., 1995). The MM VIII+ is translated to a peak ground acceleration of 0.24g for reek or stiff soil sites by Toppozada and others (1995). However, Krinitzsky and Chang (1987) equate a MM VIII+ in the near field to a peak ground acceleration of nearly 0.5g. Attenuation relationships for peak ground acceleration developed by C.B. Crouse (1991) and by Geomatrix Consultants (1994) for a subduction zone earthquake located along the interface of the two plates indicate that peak ground accelerations of up to 0.38g and possibly up

to 0.83g (one standard deviation over the predicted value). A M 9 event on the CSZ could produce even greater shaking intensity and larger peak ground accelerations.

Subduction along the CSZ could potentially produce sufficient strain in the overlying North American plate to cause one or more of the many northwest trending, high-angle reverse faults to rupture either prior to or subsequent to a rupture of the CSZ. There are several high-angle reverse faults that occur with 24 kilometers of Crescent City that are listed has having been active during the Pleistocene and one as having been active during late-Pleistocene; although none as having been active within Holocene (last 11,000 years). However, one should not rule out the possibility of reactivation of these faults. The closest fault to Crescent City that has been active during the Pleistocene is a northwest trending, high-angle reverse fault dipping towards the northeast. The surface of this fault lies 4.2 kilometers to the southwest of Crescent City. Earthquakes along those Pleistocene faults could range from M 6.0 to M 7.0 and generate peak ground accelerations in Crescent City Harbor up to 0.63g and possibly greater (predicted value plus one standard deviation).

4.4 Tsunami

Earthquakes along the Pacific-rim have historically produced seismic sea-waves; such a sea wave is known as tsunami. Tsunamis are known to have impacted the Crescent City Harbor area. The largest tsunami recorded during the relatively short period of written history of the Northern California Coast occurred during the late evening and early morning of 27-28 March 1964 as a result of the M 9.2 Alaska earthquake, March 1964. The tsunami generated by the earthquake flooded significant portion of Crescent City and caused extensive damage to the harbor area. Others have estimated the combined damage to public and private property at approximately $16 million. The estimated maximum wave height ranged between 22 and 26 feet. The floodwater from the wave runup reached approximately +20 feet MLLW. The estimated 100-year tsunami event for Crescent City, according to a 1978 WES report by J. R. Houston and A.W. Garcia, is predicted to have wave runup to approximately +13 feet MLLW while the 500-year event is predicted to reach approximately +25 feet MLLW.

The expected tsunami modeled by NOAA for an earthquake of M 8.4 generated on the southern segment of the CSZ would have a wave height of 30 feet in water 150 feet deep. The wave height can be expected to grow taller as the bottom shoals entering the harbor area. The estimated runup as modeled is expected to reach nearly +44 feet MLLW or approximately 40 feet NGVD (1929), exceeding the prediction for the 500-year event. The site location of the existing upland disposal site was inundated by the 1964 tsunami; a similar size event would overtop the existing levees and cause serious erosion damage. The anticipated tsunami from the M 8.4 event would have a significantly higher wave that would overtop the proposed raised crest elevation of +19 feet MLLW for the upland disposal site, and would probably destroy the site. Even a tsunami similar to the March 1964 event would probably cause very serious damage to the proposed raised levees, if in fact it did not over top the site. Although the proposed levee height should be able to withstand being overtopped by a 100-year event, the levees may not be able to withstand erosive force of the wave train. Generally two or more seismic sea-waves accompany

a tsunami event; the 1964 Crescent City event had at least 4 waves, the fourth wave being the largest.

4.5 Channel Side Slopes

Slope Stability Analyses. The Corps computer program, UTEXAS3, for slope stability analyses was used to determine the factor of safety for the design slope for the after construction case. Spencer's method of analysis was used to locate the slip surface. Three cross sections with different soil profiles were analyzed (See Attachment 4 for UTEXAS3 Results). A 1V on 3H design side slope was selected. A discussion of the slope stability analyses are presented in the following paragraphs.

Section 1. Boring CC-1 was used to develop the soil profile for the western reach of the channel deepening. Boring CC-1 is typical of the soil profiles of borings CC-2 and CC-3. The after construction case safety factor is 3.01 (See Plate 3).

Section 2. Boring CC-4 was used to develop the soil profile for the eastern reach of the channel deepening along the existing landward jetty. The after construction case safety factor is 1.50 (See Plate 4).

Section 3. Boring CC-5 was used to develop the soil profile for the eastern reach of the channel deepening. The after construction case safety factor is 4.24 (See Plate 5).

4.6 Dredgeability

Based upon the seismic refraction velocities and the anticipated characteristics of the bedrock, it is believed that the softer sheared to closely fractured shale can be excavated by a dipper buck dredge or a long-armed backhoe either of which equipped with reek teeth. A bucket wheel dredge equipped with Tungsten-carbide cutting teeth would also work. A bucket wheel dredge or the backhoe might also be able to dig the harder sandstone. However, a long cutter boom equipped with a rotor-head cutter and using carbide-tipped cutting teeth should be able to excavate the bedrock with little difficulty. A follow-up suction dredge would easily remove the rock debris left behind by the rotor-head cutter. The excavation or dredging of the harder material from the Inner Harbor Channel in 1983 was accomplished by breaking the harder material using a long, heavy gad free falling through the water column. The gad was raised and positioned using the derrick of a clam-shell dredge. A clam-shell bucket with rock teeth was used to remove the broken material. The gad was used on the harder high points and did not have to remove the more extensive thickness of bedrock that is expected in the entrance channel to the small boat basin. Using Caterpillar's ripper performance charts, a D9R bulldozer with duel shank rippers would probably be the smallest effective piece of equipment if similar rock was to be excavated on land.

The sediment found in the core borings, as discussed in Section 4.2, indicate that the channel may be dredged by a hydraulic dredge to an approximate depth of -14 feet MLLW, and probably the one-foot of additional deepening for advance maintenance and the extra foot allowable for overdepth as well. However, as also discussed in Section 4.2, knobs of bedrock may extend above the one-foot of allowable overdepth and into the channel prism above -14 feet MLLW. In

the event bedrock is found between -14 feet and -16 feet MLLW, it is anticipated that it will be left in-place.

In the event bedrock extends above -14 feet MLLW, the rock material will have to be removed to at least a depth elevation of the project prism and preferably below the advance maintenance depth of -15 feet MLLW. Based upon the seismic refraction velocities and the anticipated characteristics of the bedrock, it is believed that either a dipper bucket dredge or a long-armed backhoe, both of which equipped with rock teeth, can excavate the softer, sheared to closely fractured shale. A bucket wheel dredge equipped with tungsten-carbide cutting teeth would also work. A bucket wheel dredge or the backhoe might also be able to dig the harder sandstone. However, a long cutter boom equipped with a rotor-head cutter and using carbide-tipped cutting teeth should be able to excavate the bedrock with little difficulty. A follow-up suction dredge would easily remove the rock debris left behind. The excavation or dredging of the harder material from the Inner Harbor Channel in 1983 was accomplished by breaking the harder material using a long, heavy gad free falling through the water column. The gad was raised and positioned using the derrick of a clam shell dredge. A clam shell bucket with rock teeth was used to remove the broken rock material. The gad was used on the harder high points and did not have to be used to remove more extensive thickness of bedrock. Using Caterpillar's ripper performance charts, a D9R bulldozer with duel rippers would probably be the smallest effective piece of equipment if similar rock material were to be excavated on land.

4.7 Upland Disposal Site Design

4.7.1 Drilling. Three (3) soil borings were drilled from 24 to 25 November 1998. The final locations of the borings drilled are shown in Plate 6. Borings CC-6, CC-7, and CC-8 were drilled to depths of 26.5, 30.5, and 25 feet. The borings CC-7 and CC-8 were moved from the original location at the floor of the disposal site to the top of the baffles in the disposal site due to the ponding of 4 feet of water from recent rains in the disposal site. A hollow stem auger was used for the first 15 feet of the boring and for the remainder a rotary wash drilling technique was used. The borings were advanced using a Weasel Crawler and Concore N-68 track-mounted drill rig. The Report of Field Activities is in Attachment 2.

4.7.2 Sampling. Soil samples were obtained at approximately 3-foot intervals at each boring location. Disturbed and relatively undisturbed soil samples were recovered using a 1.4-inch I.D. SPT split-spoon sampler and a 2.0-inch I.D. California split-barrel sampler with brass liners. A 140-pound hammer with a 30-inch fall drove the sampler. The blows to drive the sampler the last 12 inches were recorded in the boring logs on Plate 7. After the drilling was completed, the holes were backfilled with drill cuttings and compacted within the upper two to three feet of the boring.

4.7.3 Laboratory Testing. Geotechnical Consultants, Inc conducted laboratory testing. Seven moisture content determination tests and eleven grain-size distribution tests were performed on selected samples from the three borings. Laboratory test results are recorded on the boring logs in Plate 7.

4.7.4 Analyses. Analyses were performed to determine the stability of the proposed levee sections. Borings CC-6 through CC-8 indicates the material at the site consists of loose to dense silty sands (SM), poorly graded sands (SP), and sandy clays (SC).

4.7.5 Slope Stability Analyses. The Corps computer program, UTEXAS 3, for slope stability analyses was used to determine the factor of safety for the design slope for the after construction case. Spencer's method of analysis was used to locate the slip surface. Three cross sections with different design water level profiles were analyzed. One typical soil profile was developed from borings CC-6, CC-7, and CC-8. A 3H on 1V design side slope was selected for the model. A discussion of the slope stability analyses is presented in the following paragraphs.
Low Water Level Case. The Low Water Level Case models the disposal site as drained. The safety factor for this case is 1.96 (See Plate 8).

Rapid Down Draw Case. The Rapid Down Draw Case models the disposal site where the water level is lowered quickly. The safety factor for this case is 1.49 (See Plate 9).

High Water Level Case. The High Water Level Case models the disposal site as full. The safety factor for this case is 2.11 (See Plate 10).

4.7.6 Using the information described above, a mass balance was performed to determine the optimum size for the dredged material needs. The results of the analysis produces a site with 63,000 cubic yards (CY) of space available for storage of the dredged material and water slurry from the dredging operation. The saturated loose sand would be susceptible to liquefaction during a seismic event.

4.8 References

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5. PROJECT DESIGN

5.1 Navigation Features

The design of general navigation features was accomplished in accordance with Corps criteria, procedures, and standards to accommodate the actual and projected vessels calling at Crescent City Harbor. The information on the vessels and their operations in the navigation channels was obtained from the Crescent City Harbor documents.

5.1.1 Channel Design

The channel width design dimensions are based on the dimensions of the design vessel and guidance contained in ER 1110-2-1615, "Hydraulic Design of Small Boat Harbors." Several channel alternatives of varying widths were initially considered, but no additional benefits would be gained through channel widening beyond the minimum acceptable width. Therefore, a channel design was developed for a minimum acceptable channel width. Based on dimensions of the design vessel and factors in Table 3-1 of EM 1110-2-1615, the recommended channel design is a minimum two-way traffic channel with a width of 140 feet to a maximum of 210 feet near the existing Federal channel. From the economic optimization, the recommended depth of the channel is -14 feet based on a cutterhead hydraulic dredging operation. The recommended channel would allow for significantly improved access and eliminate most of the direct and indirect tidal delays, although extreme negative tides may still cause minor tidal delays several times a year.

Sediments in the proposed channel area should be able to withstand a 1V:1H slope cut only in rock. A 1V:3H slope cut will be used for the sediment material side-slope stability. This is consistent with the design of the Inner Harbor channel.

TABLE 5.1
Total Construction Depth (MLLW)

DESIGN DEPTH	ROCK EXCAV	ADV. MAINT.	OVER DEPTH	TOTAL DEPTH
15	1	0	1	17
14	0	1	1	16
13	0	1	1	15

TABLE 5.2
Total of Federal and Non-Federal Excavation

		FEDERAL			NON-FEDERAL		
TOTAL DEPTH FT (MLLW)	TOTAL CY	CHAN CY	1' OD CY	ROCK OR ADV. MAINT. CY	CHAN CY	ROCK OR ADV. MAINT. CY	1'OD CY
17	42500	27450	5900	4650	2900	800	800
16	37700	22700	5300	5300	2800	800	800
15	22500	8600	5300	5300	1700	800	800

Rock excavation - For the Federal channel excavation, the rock was broken by a battering ram and loaded with a clamshell.
Sideslopes of the access channel will be 1 vertical on 3 horizontal.

5.1.2 Design Vessel

The Crescent City Harbor District was asked for their input in defining the design vessel for the access channel to the Small Boat Basin. Consultation with the Harbor District and examination of the existing fleet indicate that the proposed channel should be built to accommodate a 80-foot-long vessel with a beam of 24-feet.

The depth of the access channel was calculated by the addition of the design draft, 11.5 feet, of a 80 feet long vessel, the squat that is 0.5 feet, and the safe clearance of 2 feet. The total depth is equal to 14 feet. The width of the channel is obtained by multiplying the factor of 5.2 by 24 feet. 24 feet is the width of the beam of the typical boat. 5.2 is a factor used for two lanes of boats, it is a minimum factor. This equals 124.8 feet width. 15.2 feet is added to total 140 feet width, this is added as a factor of safety for the 90 degree turn into the boat marina. The references for the above data are EM 1110-2-1615, Hydraulic Design of Small Boat Harbors, and the Dredging Fundamentals Course by PROSPECT, the section on Design of Navigation Projects.

5.2 Disposal Site

Upland Disposal Site -- The Crescent City Harbor District owns and operates an upland dredged material disposal site. This site, located just north of the Small Boat Basin (refer to Plate 1), is the recommended disposal alternative. Replacement and raising of the present levees by two to three feet would require using material from inside the site and limited offsite material to increase its capacity. This levee height increase would accommodate 37,670 CY of dredged material and space for the water pumped through the pipeline with the dredged material. The upland disposal site in its present condition has a capacity of approximately 27,000CY. The present levee elevation ranges from 14.3 feet to 17.8 feet MLLW. See Plate 11, showing the original elevation contours. The site is approximately 7.1 acres and disposal site improvements would have approximately the same footprint and area as the present site. The levees would have a uniform elevation of 19 feet MLLW to provide a capacity of 63,000CY. See Plate 11, showing

the construction lines overlay. Also, see Plate 12, showing the cross sections of the outside levee and the complete disposal site. No construction activity would take place in the wetland areas along the north and west sides of the disposal site.

5.3 Dredging Plan

For cost estimating purposes it is assumed the dredging will be performed in one contract by a prime contractor who will execute all the dredging and disposal site operations unless noted otherwise. Mobilization and demobilization for the disposal site improvements would each require an estimated one work day of eight hours. Several pieces of equipment would be needed, including dozers, graders, compactors, large capacity hauling trucks and other equipment. Mobilization and demobilization for dredging plant and equipment is based on the preparation, transfer, set-up and removal of plant and equipment required. The dredging plant consists of one 12-inch cutterhead hydraulic dredge, with approximately 3,000 feet of pipes, and one D7 dozer. The cost estimate assumes that the contractor will dredge all of the overdepth yardage.

The order of work for the upland disposal site improvement would proceed and follows.

1) Mobilization of equipment (estimated 1 work day).
2) Improvement of upland site (estimated 45 work days, 5 days/week)
3) Demobilization of equipment (estimated 1 work day)
   (estimated work days are based on 8 hours per day)

The order of work dredging would proceed as follows:

1) Mobilization of plant and equipment (est. 7 work days)
2) Dredging and pumping to disposal area (est. 11 work days)
3) Demobilization of plant and equipment (est. 7 work days)
4) Estimated downtime of 40%, based on 24 hours per day, 7 days per week.

Dredging is assumed to be accomplished using a 12-inch cutterhead hydraulic dredge and directly pumping the dredged materials to the upland disposal area. A dozer at the disposal site would spread the dredged material.

Contract duration would be 83 calendar days, including mobilization and demobilization, based upon the assumed plant and estimated production rates.

5.4 Hazardous and Toxic Materials

The sediment sampling and chemical testing did not find any unsafe levels of dredged material unsuitable for the upland disposal site.

5.5 Operation and Maintenance Requirements

Maintenance dredging of the Federal channels will remain the responsibility of the federal government. The proposed channel would be added to the present operation and maintenance (O&M) cycle, which occurs every five years. The shoaling rate of 0.4 feet per year allows the five year cycle to be economically justified. Section 2.7, Conclusions, describes the shoaling rate details for the selected plan. The O&M activity would use a Section 102 ocean disposal site for all the Federal channels. All the Federal channels would have and average volume of 76,000 CY of dredged material every five years.

5.6 Real Estate

The real estate requirements for this project consider the three depth evaluations. These requirements consist of an upland disposal site for placement of the dredged material, an easement for a pipeline to transport the material directly to the disposal site, a construction staging area, and a road or access route to haul any rocky material that cannot be transported through the pipe to the disposal site for a total of 9.88 acres. The required real estate is all located on the Crescent City Harbor, under one ownership, that owner being the sponsor. There are no special value considerations or crediting principles that are applicable to existing sponsor ownership of the required LERRDs.

5.7 Relocations

No structural relocations are required for the project.

6. CONSTRUCTION PROCEDURE AND WATER CONTROL PLAN

Water overflow from the disposal site will be kept to a minimum by circulation control berms and outlet weir. Dredged material will be pumped into the disposal site using the pipeline presently in place.

7. CONSTRUCTION MATERIALS

Construction materials consisting of 5,500 CY (est.) of fill material from an outside source and materials to construct a weir would be required to maintain or raise the disposal site levee.

8. COST ESTIMATES

The following Table 8.1 is a preliminary, detailed MCACES cost estimate summary for the selected plan. Table 8.1, part 1, represents the total Federal costs for GNF without cost sharing figures separated. The non-Federal costs, part 2 on page 16, are

100-percent for the sponsorÁs area of the project. Plate 1 shows the coordinates of the Federal and non-Federal areas of the project. The selected plan is -14-foot MLLW with l-foot advanced maintenance (AM) and 1 -foot overdepth (OD) allowance. The contractor would not be expected to excavate rock from the overdepth allowance. The volume for rock material below , 15 MLLW is not included in the cost estimate below.

TABLE 8.1

MCACES Preliminary, Detailed Cost Summary
-14Á MLLW +1Á OD + 1Á AM

	QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT
1 FEDERAL COST,Alt.-14'+1'OD +1'						
1-01 LANDS & DAMAGES	1.00	JB	51,700	0	51,700	51700
1-02 LERRDS	1.00	JB	145,300	0	145,300	145300
1-12 NAVIGATION, PORTS & HARBORS						
1-1201 Mobilization & Demobilization	1.00	JB	267,393	26,739	294,133	294133
1-1216 Dredging Mud	26510	CY	160,916	24,137	185,053	6.98
1-1220 Advanced Maintenance Dredging	6800.00	CY	41,276	6,191	47,467	6.98
1-1240 Land Disposal Site Preparation	1.00	EA	221,539	43,535	265,074	265074
1-1299 Aids to Navigation	1.00	JOB	12,482	3,121	15,603	15603
TOTAL NAVIGATION, PORTS & HARBORS	1.00	JB	703,606	103,724	807,330	807330
1-30 PLANNING, ENGINEERING & DESIGN	1.00	JB	699,650	0	699,650	699650
1-31 CONSTRUCTION MANAGEMENT	1.00	JB	80,000	0	80,000	80000
TOTAL FEDERAL COST,Alt.-14'+1'OD +1'	1.00	JOB	1,680,256	103,724	1,783,980	1783980
2 NON-FEDERAL COST,Alt-14'+1'OD+1'						
2-01 LANDS & DAMAGES	1.00	JB	15,000	0	15,000	15000
TOTAL LANDS & DAMAGES	1.00	JB	15,000	0	15,000	15000
2-12 NAVIGATION, PORTS & HARBORS						
2-1216 Dredging Mud	3450.00	CY	20,942	3,141	24,083	6.98
2-1220 Advanced Maintenance Dredging	910.00	CY	5,524	829	6,352	6.98
TOTAL NAVIGATION, PORTS & HARBORS	1.00	JB	26,465	3,970	30,435	30435
TOTAL NON-FEDERAL COST,Alt-14'+1'OD+1'	1.00	JOB	41,465	3,970	45,435	45435
TOTAL CRESCENT CITY HARBOR	1.00	JB	1,721,722	107,693	1,829,415	1829415

ATTACHMENT 1

CESPN-PE-EH

11 January 1999

MEMORANDUM FOR CESPN-PE, ATTN: Gary Flickenger

SUBJECT: Crescent City Shoaling Rate Investigation.

1. It was requested that a shoaling analysis be completed to determine the expected maintenance dredging requirements of the proposed Small Boat Basin Access Channel in Crescent City Harbor. The project would deepen the channel from twelve (12) feet (MLLW) to fifteen (15) feet (MLLW).

2. Based on a comparison of bathymetric surveys for Crescent City Harbor from 1993, 1995, and 1998, it was determined that over the last five years that the average shoaling rate within the Small Boat Basin Access channel was two-tenths (.2) of a foot per year.

3. An analysis utilizing two seperate methodologies was conducted to estimate the expected rate of shoaling upon completion of the deepening project. It was found that the shoaling rate should not increase significantly. To account for limitations in the analysis, a conservative increase of two-tenths (.2) of a foot per year should be used, leading to an overall shoaling rate of four-tenths (.4) of a foot per year. This value represents the upper bound of the expected post project, shoaling rate. A doubling of a channel's shoaling rate after deepening rarely, if ever, occurs.

4. Analysis methodology and results are discussed in more detail in Attachments 1 and 2. Should there be any questions regarding this investigation contact John Winkelman at extension 8595.

Carlos R. Hernandez

CARLOS R. HERNANDEZ
Chief, Hydraulics and Coastal Section

Attachments

CF: CESPN-PE RF
CESPN-PE-E
CESPN-PE-EH

JHW JHW
CESPN-PE-EH
23 DEC 1998

CRH CRH
CESPN-PE-EH

KPK
CEPSN-PE-E

ATTACHMENT 1

TO

11 JANUARY 1999
MEMORANDUM

Background

The current maintained depth of the Crescent City Small Boat Access Channel is twelve (12) feet (MLLW). It is the goal of the proposed project to deepen this channel to fifteen (15) feet (MLLW). In the 1995 Crescent City Harbor General Investigation Study, shoaling rates for the area of concern were estimated at one (1) foot per year. This rate was largely determined using the 1970 report by Roberts.

Problem Statement

If the one (1) foot per year shoaling rate is correct, the maintenance dredging required to keep the channel at the proposed depth would result in an unfavorable benefit to cost ratio. It was therefore requested that the shoaling rate for the area be reinvestigated for the existing and proposed channel configuration.

Current Condition

Ideally a larger study that would have included wave energy, tidal currents, sediment loads, and numerical modeling could have been performed. However, it is understood that due to time and cost restraints this option was not available. Working with the limited resources available, the problem was looked at using very basic analytic tools.

Using available bathymetries from 1993, 1995, and 1998 the shoaling rates over the last five years were determined. Although a longer record would be better these bathymetries provided a fair base. In this analysis (Attachment 2) it was found that the average shoaling rate over the last five years along the channel was two-tenths (0.2) of a foot per year, with a standard deviation of one-tenth (.1) of a foot. As the standard deviation suggests, the shoaling rate was fairly uniform over the study area. The highest rate of accretion was found to be seven-tenths (.7) of a foot per year between 1995 and 1998 near the entrance to the Small Boat Basin. The information from the surveys shows that the current shoaling rate is significantly lower than the predicted one (1) foot per year.

Post Project Condition

The rate of shoaling in a particular area depends upon hydrodynamic characteristics and sediment load in the water column. A change of either of these components will result in a change in shoaling rate. Changing the configuration of a navigation channel will almost certainly change the local hydrodynamics and sometimes change the sediment load quantities.

The survey information on its own suggests that shoaling will not increase significantly in the channel once it is deepened. The proposed increase in depth of three (3) feet should not cause significant changes in the hydrodynamic characteristics of the area. To support this opinion the Conservation of Sediment Equation (Equation) and the Shoaling Rate Equation (Equation 18) were used. The use of the Conservation of Sediment

Equation was made difficult by the lack of available data such as such as, current velocities and directions, sediment load, bed load, falling velocities, etc. To compensate for the lack of information several assumptions were made.

<u>Continuity Equation for Sediment</u>

Assumptions

1. **The flow in the harbor crosses the channel at 90 degrees to the channel's axis.** This situation has typically proven to cause the largest amount of shoaling. As the flow crosses the channel the velocity drops due to the increased area of the channel. Equation 1 shows that as area increases, velocity must decrease to conserve volume flow.

$$Q=V*A \qquad \text{Equation 1.}$$

Q = volume flow of water
V = velocity of current
A = cross sectional area of flow

As the current's angle of incidence to the channel decreases, this condition is complicated by refraction. Due to the change in depth, the streamlines of the currents are curved and compressed, causing the current speed to increase near the bottom. Therefore, it is possible to have the two seperate effects on the current cancel out.

2. **No additional sediment inputs.** It is assumed that the only source of sediment is from littoral sources.

3. **Velocities within harbor and study area are low.** Since current velocity data was not available the velocities were assumed to be low. This was based on the fact that the harbor is fairly open and the findings of the previously mentioned reports. Velocities in the range of one (1) foot per second were estimated.

4. **The water depth will be measured at MTL.** To average the effect of changing water levels all calculations were made using water depths at MTL. This would cause the existing channel to be sixteen (16) feet deep, and the proposed channel to be nineteen (19) feet deep.

The Continuity Equation for Sediment basically states that the sediment in a water column must be preserved. The amount entering a control volume minus the amount settling on the bottom will equal the amount leaving the control volume. This is demonstrated in Equation 2. From this general premise, Equation 3 was formulated to calculate shoaling rates. This equation is basic and neglects numerous factors, but for

this study and the level of detail provided it was sufficient. Both equations are based on the assumption that the only source of sediment is from suspended sediment.

$$Q_{in} - Q_{out} = \text{sediment volume change (shoaling rate)} \qquad \text{Equation 2.}$$

$$(\Delta h/\Delta t) = -[1/(1-n)](\Delta q_s/\Delta x) \qquad \text{Equation 3.}$$

where

h = bottom elevation
t = time
n = sediment porosity
q_s = rate of transport of suspended load
x = coordinate along streamline

Equation 3 states that the rate of channel infilling (change in h over t) will equal the amount of sediment settling out ($\Delta q_s/\Delta x$) times a porosity factor. The ($\Delta q_s/\Delta x$) term can be broken down into Equation 4. This term states that the rate at which sediment accumulates can be described by taking the difference of the quantity of sediment in the water entering the control volume and the amount of sediment in the water column exiting the control volume. This is the same relationship as Equation 2.

$$(\Delta q_s/\Delta x) = (q_{so} - q_s)/L_s \qquad \text{Equation 4.}$$

where

q_{so} = volume of sediment entering control volume (entering channel)
q_s = volume of sediment leaving control volume (leaving channel)
Δq_s = volume of sediment retained in control volume (shoaling in channel)

The L_s term in Equation 4 gives the length scale that the sediment settling will occur over.

$$L_s = (\varepsilon_s U_b)/w^2 \qquad \text{Equation 5.}$$

where

ε_s = turbulent vertical diffusion coefficient
U_b = mean horizontal velocity of suspended material
w = settling velocity of sediment

The ε_s term can be approximated as

$$\varepsilon_s = wD/3 \qquad \text{Equation 6.}$$

where

$$D = \text{depth}$$

If all of the substitutions are made, Equation 3 becomes Equation 7.

$$(\Delta h/\Delta t) = -[1/(1-n)][(q_{so} - q_s)/(DU_b/3w)] \qquad \text{Equation 7.}$$

To find the difference between the existing shoaling rate and the future shoaling rate, Equation 7 can be used by subtracting the existing rate from the future rate.

$$\Delta(\Delta h/\Delta t) = (\Delta h/\Delta t)_{15} - (\Delta h/\Delta t)_{12} \qquad \text{Equation 8.}$$

Substituting the variables and factoring out constants results in Equation 9.

$$\Delta(\Delta h/\Delta t) = \{3w/[(1-n)DU_b]\}[(q_{so} - q_s)_{15} - (q_{so} - q_s)_{12}] \qquad \text{Equation 9.}$$

The porosity term, $(1/(1-n))$, will remain constant for both situations. The settling velocity, w, will remain constant for both situations. The DU_b term will remain constant even though the terms it is comprised of will change. This is due to the relationship of D and U_b (as depth increases current speed decreases). This relationship is shown as Equation 1. This equation shows that the velocity and the depth are directly proportional. For this case, as the depth increases by a factor of 1.19 times (16 ft MTL to 19 ft MTL) the velocity will decrease by a factor of .84. If it is assumed that the sediment is moving with the same velocity as the water then U_b will decrease as the water velocity decreases. Carrying out the subtraction in Equation 9 results in equation 10.

$$\Delta(\Delta h/\Delta t) = -[3w/(1-n)DU_b][q_{s12} - q_{s15}] \qquad \text{Equation 10.}$$

Using an experimentally determined relationship between q and V (Equation 11), the q terms can be related to each other in terms of velocities (Equation 15).

$$q = \alpha V^{3/2} \qquad \text{Equation 11.}$$

The α term is a calibration constant that is normally determined experimentally. It is usually on the order of 4.0 x 10^{-5} for English units (Port Engineering 1990).

$$q_{s12} = \alpha V^{3/2}{}_{12} \qquad \text{Equation 12.}$$

$$q_{s15} = \alpha V^{3/2}{}_{15} \qquad \text{Equation 13.}$$

$$V_{15} = .84 V_{12} \qquad \text{Equation 14.}$$

$$q_{s15} = \alpha(.84V)^{3/2}{}_{12} \qquad \text{Equation 15.}$$

Substituting

$$\Delta(\Delta h/\Delta t) = \{3w\alpha/[(1-n)DU_b]\}[V^{3/2}{}_{12} - (.84V)^{3/2}{}_{12}] \qquad \text{Equation 16.}$$

$$\Delta(\Delta h/\Delta t) = \{3w\alpha/[(1-n)DU_b]\}[(.23)V^{3/2}{}_{12}] \qquad \text{Equation 17}$$

Based on Equation 17 and the following input values:

$w = .8$ ft/s
$n = 35\%$
$D = 16$ ft
$U_b = 1$ ft/s
$V = 1$ ft/s

leads to an increase in shoaling of 2×10^{-6} feet per year. Obviously it is not practical predict a change in shoaling rate that small for the area of interest, but instead it indicates that the increase in shoaling rate will be small. A sensitivity analysis of Equation 17 was performed and it was quickly determined that large changes in the input values would be needed to effect the output. The largest changes occurred when the velocity was changed due to the power it is raised by. This term still does not change the output significantly.

Shoaling Rate Equation

The Corps has used the Shoaling Rate Equation in the past to help quantify any expected increase in shoaling. It is based on similar principals as Equation 1 and the Conservation of Sediment Equation. As depth increases, the cross-sectional area of the water column increases, which means current velocity must decrease a proportional amount to conserve

mass flow. As current speed drops, the ability of the water column to suspend sediment decreases, causing a certain amount of sediment to precipitate

$$S_2 = (d_2^2/d_1^2) \times S_1 \qquad \text{Equation 18}$$

where

d_1 = starting depth
d_2 = depth after dredging
S_1 = pre-deepening shoaling rate
S_2 = post-deepening shoaling rate

Based on Equation 18 and the following input values:

$d_1 = 16$
$d_2 = 19$
$S_1 = .2$ foot/year

leads to an increase of eight-hundredths (.08) of a foot per year, or an overall rate of .28 foot per year.

Conclusions

Due to the relatively small change in depth, of an already existing natural channel, any expected increase in shoaling would be small. Using two basic methods, the expected shoaling rate increase was estimated. Both methods showed that the increase should be small. Considering the level of accuracy of the calculations, and the assumptions that were made, a safety factor was added to the calculated results leading to a four-tenths (.4) of a foot per year shoaling rate. This value represents a doubling of the exiting shoaling rate. An increase of this magnitude rarely, if ever occurs after a deepening project. This is an average for the entire channel, and does not account for "hot spots". As shown in the past bathymetries, certain areas are more susceptible to shoaling. These areas may shoal several times faster than the rest of the channel. It is impossible to determine if and where these spots will occur without a more detailed study.

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ATTACHMENT 2

TO

11 JANUARY 1999
MEMORANDUM

CRECENT CITY HARBOR NAVIGATION IMPROVEMENT PROJECT
CALCULATION OF SEDIMENT DEPOSITION

By:

Ricardo A. Galdamez
Civil Engineer

PROCEDURE:
The annual rate of sediment deposition on the proposed extension channel area was determined from the data obtained by three hydro-surveys performed on October 1993, January 1995 and January 1998 respectively. The surveyed data was then used to compare the change of depth between all matching individual survey lines between those years.

All three hydro-survey maps were superimposed on to each other to find the locations along the proposed channel to determine the location of overlapping survey lines. This method, although limited to a relative few matching points within the channel, permitted a more accurate measurement of the sediment that had accumulated at those general areas between the years of the surveys.

Lastly, the average amount of sediment accumulated between surveys was divided by the number of years elapsed from survey to survey, to determine the rate of sediment deposition per year.

FINDINGS:
Some individual areas experienced a rate of deposition of as much as 0.70 foot per year, whereas others experienced no change. The rate of deposition gathered from the surveys of 1993 and 1995 was determined to be about 0.2 foot per year, while the surveys between the years of 1995 and 1998 yielded a rate of about 0.3 foot per year. The rate of sediment deposition determined from the 1993 and 1998 surveys show was 0.2 foot per year. This shoaling rate was deemed the most accurate since it was determined from the longest time period, and from the best matching survey lines.

CRECENT CITY HARBOR NAVIGATION IMPROVEMENT PROJECT

POST DREDGE SURVEY 93		
SECTION	AVEG DEPTH FT.	
A	14.32	
B	13.41	
C	16.52	
D	15.39	
E	13.7	
F	12.61	
G	13.04	
H	12.61	
I	12.44	
J	11.45	
K	13.44	
L	12.84	
M	14.36	
N	14.58	

SURVEY JANUARY 1995		
SECTION	AVEG DEPTH FT.	
A	15.53	
B	13.36	
C	12.95	
D	15.62	
E	14.06	

SURVEY JANUARY 1998		
SECTION	AVEG DEPTH FT.	
A	13.31	
B	12.55	
C	15.42	
D	13.95	
E	11.16	
F	12.11	
G	11.73	
H	11.55	
I	12.1	
J	10.3	
K	11.55	
L	123.67	
M	14.06	

NOTE: LOOK AT HAND MARKED SECTIONS ON SURVEY MAPS FOR BETTER ID
LETTERS DENOTING SECTIONS DO NOT CORRESPOND BETWEEN SURVEY YEARS

CRECENT CITY HARBOR NAVIGATION IMPROVEMENT PROJECT

OVERLAP SURVEYED SECTIONS USED TO MEASURE SEDIMENT DEPOSITION				
SECTION	93 DEPTH	98 DEPTH	CHANGE	ANN. CHANGE
A	14.32	13.31	1.0	0.2
C	16.52	15.42	1.1	0.2
D	15.39	13.95	1.4	0.3
E	13.7	11.16	2.5	0.5
G	13.04	11.73	1.3	0.3
H	12.61	11.55	1.1	0.2
I	12.44	12.1	0.3	0.1
J	11.45	10.3	1.2	0.2
M	14.36	14.06	0.3	0.1
	Average for Channel		1.1	0.2
	Standard Deviation		0.7	0.1

OVERLAP SURVEYED SECTIONS USED TO MEASURE SEDIMENT DEPOSITION				
SECTION	93 DEPTH	95 DEPTH	CHANGE	ANN. CHANGE
C	16.52	16.15	0.4	0.2
E	13.7	13.65	0.0	0.0
G	13.04	12.5	0.5	0.3
	Average for Channel		0.3	0.2
	Standard Deviation		0.2	0.1

OVERLAP SURVEYED SECTIONS USED TO MEASURE SEDIMENT DEPOSITION				
SECTION	95 DEPTH	98 DEPTH	CHANGE	ANN. CHANGE
A	16.15	13.98	2.2	0.7
B	13.65	12.55	1.1	0.4
C	12.5	11.79	0.7	0.2
E	14.06	14.06	0.0	0.0
	Average for Channel		1.0	0.3
	Standard Deviation		0.9	0.3

NOTE: THE AMOUNT IN THE SHADED RECTANGLES IS THE AVERAGE RATE OF SEDIMENT DEPOSITION PER YEAR AND THE STANDARD DEVIATION

ATTACHMENT 2

SUBSURFACE GEOTECHNICAL INVESTIGATION: REPORT OF FIELD ACTIVITIES

DACW07-96-T-0034

CRESCENT CITY HARBOR
CRESCENT CITY, CALIFORNIA

Prepared for:
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Corps of Engineers
San Francisco District
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SEPTEMBER 1996
Project No. 4382

GEOTECHNICAL INVESTIGATION REPORT
Crescent City Harbor Subsurface Investigation
U. S. Army Corps of Engineers
Crescent City, California
LACO Project No. 4382

INTRODUCTION

This report presents the results of a geotechnical drilling investigation conducted by LACO ASSOCIATES, Consulting Engineers. This investigation was conducted for the U.S. Army Corps of Engineers, in the channel to the boat basin in the Crescent City harbor in Crescent City, California. Crescent City is within Del Norte County, on the northwestern-most coast of California (41° 44.7' N, 124° 11.0' W). A location map (Figure 1) showing Crescent City and a site plan map (Figure 2) showing the locations of the test borings are included in this report.

PROJECT DESCRIPTION

This project consisted of drilling five (5) geotechnical test borings in the Crescent City harbor, along the margins of the existing channel, to collect data for a proposed channel improvement project.

SCOPE OF THIS INVESTIGATION

LACO ASSOCIATES was retained to conduct the drilling operations, collect subsurface soil samples, provide descriptions of the soil materials encountered, transmit the samples to the Corps of Engineers materials testing laboratory, and to prepare this report of field activities.

GEOLOGIC SETTING

The Crescent City harbor is located on the northern coast of California (Figure 1), less than 30 miles south of the Oregon border. The area is located within the northern coast ranges geologic province. The harbor area is underlain by units of the Plio-Pleistocene St. George formation and the Cretaceous- to Jurassic-aged Franciscan Formation. Northwestern California is a seismically active area in which large earthquakes may be expected to occur during the economic lifespan of any developments on the subject property.

Two units of the Franciscan formation are usually encountered in the project area; melange and sandstone. Franciscan melange consists of a pervasively sheared argillaceous matrix containing pebble-sized to individually mappable blocks of graywacke sandstone, greenstone, chert, blue schist, serpentine, metagraywacke, gabbro and diorite. The Franciscan sandstone is commonly massive graywacke, which is more resistant to weathering, and often forms

steep cliffs. This material makes up many of the "sea stack" boulders observed along the coast.

FIELD INVESTIGATION

The field investigation phase of this project was conducted on September 17 and 18, 1996. The Corps of Engineers (COE) was represented on site by Mr. Frank Snitz from the San Francisco District office. LACO ASSOCIATES' Certified Engineering Geologist, David N. Lindberg, and staff geologist, Gary L. Manhart, logged the borings and collected the samples. Splits of selected samples were provided on-site to Mr. Paul J. Farley, senior technical specialist from Battelle Marine Services Laboratory (Sequim, Washington) for chemical analysis. The borings were drilled by personnel from P C Exploration, Inc., a drilling contractor whose operations are based in Roseville, California.

P C Exploration provided a barge-mounted drilling rig, with operators (Jerod Kump, driller, and William Merrell, assistant), for this project. The drill was a Diedrich D-25, rotary drill with a water pump mounted on the barge for circulating fluid (sea water) through the four-inch hollow drill pipe during drilling. Samples of cohesionless material were collected with a three-inch split-spoon sampler and a two-inch split-spoon sampler (SPT). Shelby tubes (3' x 3") were on hand for collecting samples of soft cohesive materials, however no soft cohesive materials were encountered in this investigation. The three-inch split-spoon sampler was the primary sampling tool utilized for this project due to the necessity of collecting a sample of sufficient volume to provide the Battelle representative with enough material for analysis. The two-inch SPT split-spoon sampler was used in boring CC 3 after a harbor bottom sediment sample of sufficient volume to satisfy the requirements of the Battelle representative had been collected, and when the three-inch sampler became difficult to drive.

In general, the procedure followed in this investigation consisted of first locating the drilling barge over the boring location and spudding small piles (thin-wall drill pipe) into the harbor bottom to stabilize the barge. Boring locations were provided by the COE representative, working with the technical specialist from Battelle, who positioned the barge with an electronic range finder and a GPS (Global Positioning System) receiver. After locating the drilling barge on one boring location, the subsequent locations were located and marked with a small buoy, over which the barge would be positioned for the next boring. Once the barge had been positioned over a boring location, the depth of the water and the time of day were noted, and drilling and sampling were commenced.

Drilling procedures consisted of first lowering the drill string to the harbor bottom, then driving the three-inch split-spoon 18 inches into the bottom sediments with a 140 pound slide hammer (30" drop), while recording the number of blows required to drive the sampler through each of three, six-inch increments. The sampler was then removed from the hole and opened. The uppermost sample was provided to the Battelle representative for quantitative chemical analysis. The material remaining was then described on the field logs and placed into brass sample tubes (2.5" x 6"), which were then sealed and labeled for shipment to the COE materials testing laboratory in Sausalito, California.

The drill string was then advanced down to the bottom of the first sampling point where the sampling process was repeated. In the first boring (CC 1), the drill string was advanced beyond the bottom of the first sample point to collect a second sample at a depth five (5) feet deeper than the initial sample. The COE representative requested continuous sampling of the harbor bottom sediments, a modification of the scope of services.

In most cases, the Battelle representative had obtained a sufficient volume of sample from the initial sampling point so that the subsequent samples could be described, packaged and labeled for shipment. Borings were advanced until either (1) refusal was achieved, (2) the depth achieved was adequate to satisfy the terms of the contract, or (3) until the on-site COE representative determined that the depth was adequate. Refusal was determined by either: (1) drill refusal; the inability of the drill crew to advance the drill string, or (2) by sampler refusal; where the split spoon required more than fifty blows to be advanced through a six-inch depth increment. The COE representative was consulted for confirmation before moving the barge to the next boring location.

CONDITIONS ENCOUNTERED

Weather conditions during this project were good to excellent. On Tuesday morning (9/17/96) it was partly cloudy with scattered, very light rain showers. By the early afternoon of September 17th, the clouds had cleared and the remainder of the work proceeded under fair skies with light winds from the northwest. Surface conditions on the harbor were excellent for this project. There was virtually no wave action in the harbor, and the range of tidal fluctuation was less than five feet during the daylight drilling hours.

On Tuesday, September 17th, a low tide occurred at 08:43 of 2.1 feet, and a high tide occurred at 14:52 of 6.8 feet, for a maximum change of 4.7 feet. On Wednesday, September 18th, a low tide occurred at 09:25 of 2.5 feet and a high tide occurred at 15:36 of 6.7 feet, for a maximum change of 4.2 feet. The actual change in water surface elevation during the

Wednesday drilling was less than the full 4.2 feet, because the drilling operations were completed by about noon. A summary of the tidal times and heights at the Crescent City harbor is attached to this report as Figure 8. Boat traffic in the harbor was moderate to light, and did not interfere with the drilling operations. Boring locations were along the edges of the channel so drilling operations did not interfere with boat traffic in the harbor.

Subsurface conditions were no impediment to the performance of the work. Surface harbor bottom sediments were soft and the spud piles utilized to anchor the drilling barge were easily placed and removed. Two spud piles proved to be adequate to hold the barge in position over the bore holes without any drift.

Tides which occurred during the drilling were discussed above. In Crescent City, and along the west coast, the mean lower low water (MLLW) is equal to zero feet on the tide gauge. To correlate the measured depths of water in the harbor and the depths in the borings to MLLW, the time at which the depth of water was noted prior to drilling was recorded. Drilling times, tidal heights, measured water depths and MLLW elevations of the harbor bottom are presented in the table below.

BORING NUMBER	TIME/DATE DRILLED	TIDAL FEET ABOVE MLLW*	MEASURED WATER DEPTH*	HARBOR BOTTOM ELEVATION: MLLW*
CC-1	11:40-13:00 9/17/96	4.30'	16.00'	11.70'
CC-2	14:20-15:10 9/17/96	6.60'	20.00'	13.40'
CC-3	10:32-12:00 9/18/96	3.00'	15.00'	12.00'
CC-4	8:45-10:00 9/18/96	2.75'	13.50'	10.75'
CC-5	15:40-17:00 9/17/96	6.50'	15.00'	8.50'
	*At the time drilling commenced.			

A summary of drilling activities, hole by hole, is presented below.

Boring CC 1: Boring CC 1 was the first boring drilled. Location of the drilling site was provided by the representatives of the COE and Battelle. The barge was located in the position directed, and the Battelle representative then came on board the barge to measure distances from the stabilized barge to check the adequacy of the location. The location was approved and drilling commenced at about 11:40 (9/17/96). A sample was collected with the three-inch split-spoon sampler at the harbor bottom surface to characterize the bottom sediments and to collect material for the Battelle representative. The sample was provided to the Battelle representative, and the material was described and logged. The representatives of the COE and Battelle then motored off to locate the next drilling site, and the drillers were directed to proceed with drilling to a point five (5) feet below the harbor bottom, where another sample was required by the contract. Before the full five (5) feet could be drilled, the COE representative returned and requested that the sampling be conducted on a continuous basis. The drilling was stopped at that point and another sample was collected by driving the three-inch split-spoon. The sampler was driven approximately 16-inches when refusal was encountered (>50 blows per 6-inches). The sampler was retrieved and it was noted that the split-spoon sampler had been driven into a fine-grained silty sandstone. The sandstone was interpreted to be part of the Plio-Pleistocene St. George Formation.

Boring CC 2: Boring CC 2 was the second boring drilled for this investigation. Boring CC 2 was located by the representatives of the COE and Battelle, and the location was again confirmed after setting the spud piles prior to drilling. Drilling began at approximately 14:20 (9/17/96), when the three-inch split-spoon sampler was driven into the harbor bottom sediments. Sampler refusal was encountered after only five (5) inches of penetration into the harbor bottom. The sampler was recovered and the sample was given to the Battelle representative. Additional drilling was attempted, but the drill string could not be advanced beyond 14.9 feet (below MLLW), so the boring was abandoned due to drill refusal with the approval of the COE representative. The barge was moved to CC 5.

Boring CC 3: Boring CC 3 was drilled last, at 10:32 (9/18/96). The site was located by the COE and Battelle representatives and the barge was spudded on the location as directed. Drilling operations began with the three-inch split-spoon sampler being driven into the surface sediments of the harbor bottom. The sample was retrieved, shared with the Battelle representative, and then described and packaged for transmittal to the COE laboratory. The drill string was advanced to the bottom of the first sampling interval and the two-inch

split-spoon sampler was driven into the sediments. Shale bedrock was encountered on the second sample, and the boring was abandoned, with the approval of the COE representative, due to encountering bedrock.

Boring CC 4: Boring CC 4 was drilled at 08:45 (9/18/96). The site was located by the representatives of the COE and Battelle, and the barge was spudded on the location as directed. Drilling operations began with the three-inch split-spoon sampler being driven into the harbor bottom. The sample was retrieved, shared with the Battelle representative, and then described and packaged for transmittal to the COE laboratory. The drill string was advanced to the bottom of the first sampling interval and the three-inch split-spoon sampler was again driven into the harbor bottom sediments. The sampler was pulled after a drive of only 8.5 inches due to sampler refusal; it required 50 blows to drive the sampler 2.5 inches into the second 6-inch increment in the harbor bottom sediments. The sampler was recovered, the sample was described and packaged, and the drill string was advanced to the point where sampler refusal was encountered. The hole was then re-entered with the two-inch split-spoon sampler, which was driven the full (18") length. The sample was recovered, described and packaged as before, and the drill string was advanced to the bottom of the sampler penetration. The hole was again re-entered with the two-inch split-spoon sampler. The two-inch split-spoon sampler could only be driven 5.5-inches in 50 blows, so it was pulled, the sample was described and packaged, and the boring was abandoned with the approval of the COE representative.

Boring CC 5: Boring CC 5 was drilled at the location specified by the representatives of the COE and Battelle, at 15:40 (9/17/96). Because the boring location was outside of the channel proper, the COE representative decided to forgo sampling in the upper sediments of the section. When drilling characteristics changed at 14.5 feet below MLLW, the two-inch split-spoon sampler was driven and a sample was collected. The sample was described, logged and packaged. The drill string was then advanced to 16.5 feet below MLLW, and another sample was collected, described, logged and packaged. The drill string was then advanced to about 21.5 feet below MLLW and the process was repeated. Sampler refusal was encountered and the boring was abandoned with the approval of the COE representative.

DISCUSSIONS AND CONCLUSIONS

The contract services of drilling and sampling five (5) soil borings in the Crescent City harbor were completed on 9/18/96. The samples were delivered to the COE materials testing laboratory in Sausalito, on 9/24/96. This report provides the supporting data

required in the contract: classification of soils encountered, logs of the borings and soil descriptions.

Due to no soft cohesive soils being encountered, no shelby-tube samples were collected in this investigation. It may have been possible to sample the upper section of the soft sandy sediments covering the harbor floor with a shelby-tube, however the necessity of recovering samples for Battelle to perform chemical analyses precluded collection of any undisturbed samples in the upper section. Any samples collected with a shelby-tube would potentially have been contaminated by the galvanized (zinc) plating on the tubes. The samples would have been disturbed by removal from the tubes to provide the Battelle representative with the material required for testing.

A three-inch diameter split-spoon sampler was employed for the majority of the sampling to provide Battelle with sufficient sample volume for quantitative chemical analysis. In addition, no liners were utilized in the split-spoon samplers due to concerns about potential contamination by the metal in the brass liner tubes. Only where the three-inch split-spoon sampler became difficult to drive was the two-inch split-spoon sampler (SPT) employed. A standard 140-pound slide hammer with a 30-inch fall was utilized to drive both the samplers. The number of blows required to drive the sampler each 0.5-foot increment was recorded and is shown on the attached boring logs (Figures 3 through 7).

Except as directed in the field by the COE representative, sampling with the three-inch split-spoon sampler, and the SPT (two-inch split-spoon sampler), was conducted at a frequency greater than one per every three feet of material. In most cases the borings were sampled continuously.

The soils encountered consisted of a dark gray, organic-rich, silty sand (SP/SM) with mollusk-shell fragments, which comprised the surface sediment covering the harbor bottom. This "upper sand" layer often became gravelly near the base of the deposit. The gravel was considered a part of the upper unit and was interpreted to represent a lag deposit at the base of the sand.

The "upper sand" layer should be relatively easy to dredge. In boring CC 1, the upper sand layer was observed to be about 4.3-feet thick and was underlain by a dense, olive-colored, silty fine sand which we interpret to be material of the Plio-Pleistocene St. George Formation. In boring CC 2, the upper sand layer was observed to be about 1.5-feet thick; the material beneath the upper sand layer was not sampled due to drill refusal. In boring

CC 3, the upper sand layer was observed to be about 2.5 feet thick and was underlain by dense black shale, of the Cretaceous- to Jurassic-age Franciscan Formation. In boring CC 4, the upper sand layer was observed to be about 2.3-feet thick and was underlain by olive-gray, fine- to coarse-grained silty sand which was interpreted to represent material of either Pleistocene marine terrace deposits, or the Plio-Pleistocene St. George Formation. In boring CC 5 the upper sand layer was observed to be about 8-feet thick; the material beneath the upper sand layer was not sampled due to sampler refusal in the basal gravel of the upper sand layer.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions and recommendations presented in this report represent the results of our best professional geological and geotechnical engineering efforts and judgments. Due to the inexact nature of the state of the art of our profession, and possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during construction will be identical to those observed and sampled during our studies. However, we have exercised a degree of care equal to, or greater than, the standard of practice presently maintained by other leading professionals in our field of engineering geology and geotechnical engineering in this area and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the probable performance of the planned project. There is no other warranty or representation, either express or implied.

ATTACHMENTS

List of Figures:

List of Attachments:

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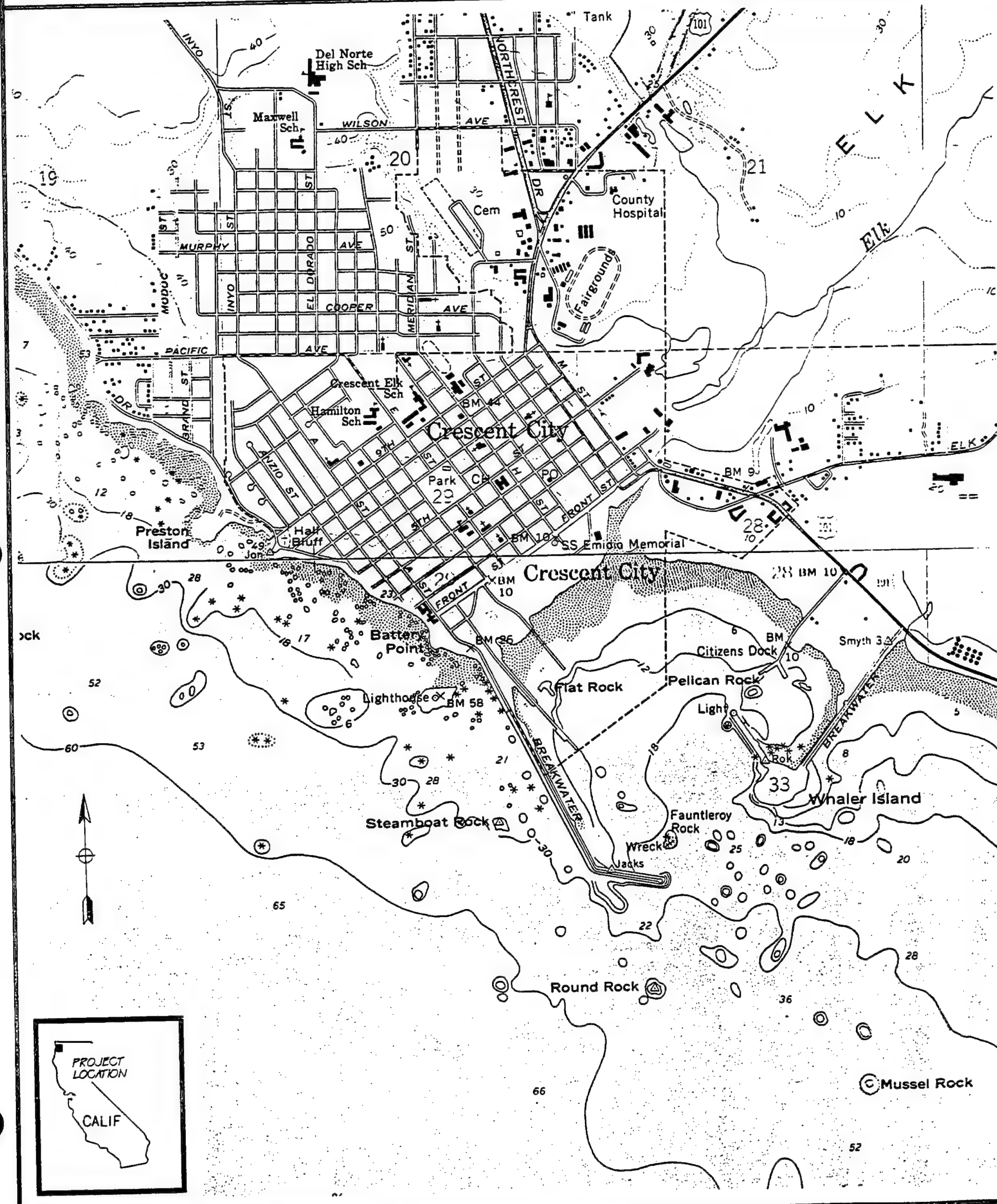
project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: FIG. 1
location: CRESCENT CITY HARBOR	date: 09/27/96	
client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
LOCATION MAP: NOT TO SCALE	date:	



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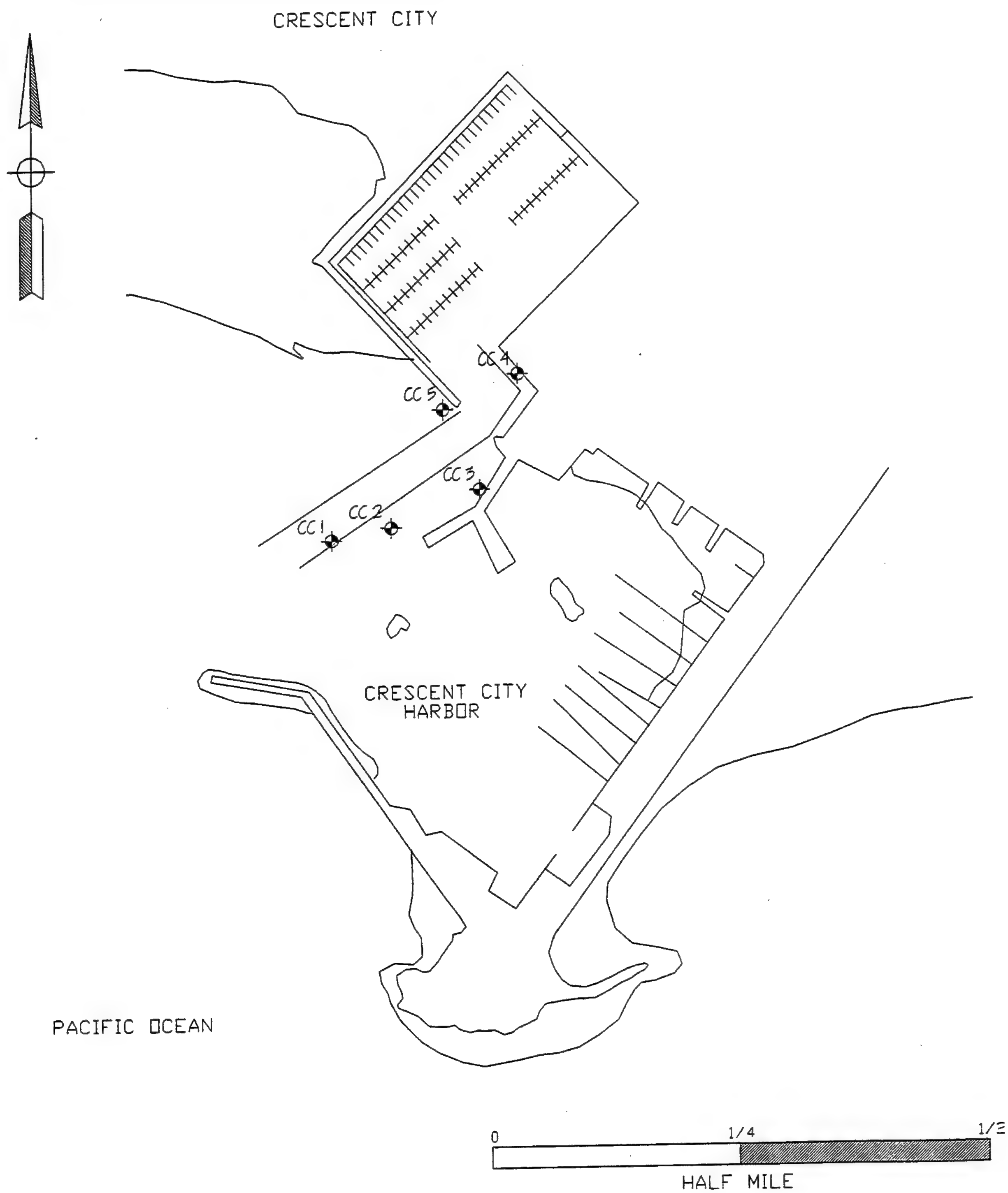
project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: FIG. 2
location: CRESCENT CITY HARBOR	date: 09/27/96	
client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
SITE MAP: BORING LOCATIONS (approx.)	date:	

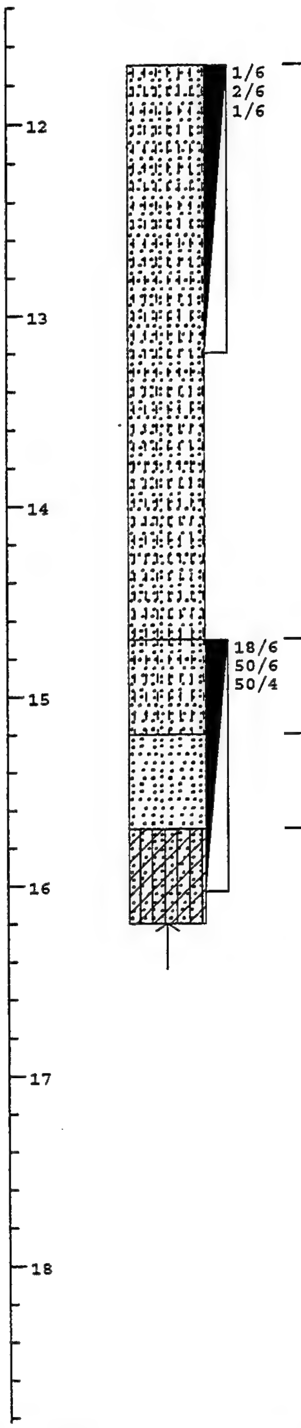


GEOTECHNICAL BORING LOG

Boring No. CC 1

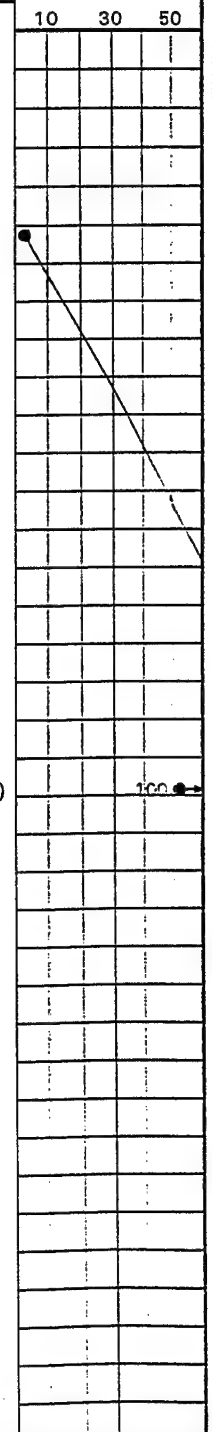
PROJECT: GEOTECHNICAL INVESTIGATION **PROJECT NO.:** 4382
BORING LOCATION: CRESCENT CITY HARBOR CHANNEL **DATE:** 9/17/96
DRILLING METHOD: DIEDRICH D-25 ROTARY on BARGE **ELEVATION:** *
DRILLER: PC EXPLORATION, INC. **LOGGED BY:** DNL
DEPTH TO WATER: **INITIAL** : NA **COMPLETION** : NA
SITE GEOLOGY: Recent sediments over bedrock of St. George Fm. and Franciscan Fm.

DEPTH FROM MLLW / SOIL SYMBOLS, SAMPLERS AND TEST DATA



Description	SAMPLER DIAMETER (inches)	Dry Density pcf	STANDARD PENETRATION TEST DEPTH	N
Harbor Bottom @ 16' below drilling barge (-11.70 MLLW).				
Silty Sand (SP-SM): very dark gray (5YR3/1w), fine grained sand, loose, saturated, with common shell fragments, and abundant organic material, strong H2S odor.	3		11.70-13.2	3
Silty Sand: (SP-SM) very dark gray (5YR3/1w), fine to medium grained sand with silt, very dense, saturated, occasional shell fragments, abundant organic material and odor of H2S.	3		14.7-16.0333	100
Sand (SP): dark gray, dense, coarse grained sand with gravel, possible basal lag deposit over bedrock.				
Sand (SM-SC): olive (5Y5/4w), silty, fine grained, weathered sandstone, dense, saturated, abundantly fractured, with numerous thin clasts of clay. Material interpretted to be sandstone of the Plio-Pleistocene St George Fm. Boring CC-1 abandoned at -16.2' (MLLW), or 4.5' below bottom of harbor due to encountering bedrock.				

STANDARD PENETRATION TEST CURVE



*Test boring CC 1 was located by COE and Battelle. Drilled 11:40 - 13:00, in 16' of water. *Estimated 4.3' above MLLW and corrected depths. (4" pipe)*

Sheet Fig. 3

LACO ASSOCIATES

GEOTECHNICAL BORING LOG

Boring No. CC 2

PROJECT: GEOTECHNICAL INVESTIGATION
PROJECT NO.: 4382
BORING LOCATION: CRESCENT CITY HARBOR CHANNEL
DATE: 9/17/96
DRILLING METHOD: DIEDRICH D-25 ROTARY on BARGE
ELEVATION: *
DRILLER: PC EXPLORATION, INC.
LOGGED BY: DNL
DEPTH TO WATER: **INITIAL** ☲ : NA **COMPLETION** ▼ : NA
SITE GEOLOGY: Recent sediments over bedrock of St. George Fm. and Franciscan Fm.

DEPTH FROM MLLW	SOIL SYMBOLS, SAMPLERS AND TEST DATA	Description	SAMPLER DIAMETER (inches)	Dry Density pcf	STANDARD PENETRATION TEST DEPTH	N	CURVE 10 30 50
	50/5	Harbor Bottom @ 20' below drilling barge (-13.4 MLLW).					
14		Sand (SP): very dark gray (5YR3/1w), fine to medium grained, very dense, saturated, with organic material and occasional shell fragments, gravel and cobbles at shoe of sampler, pronounced odor of H2S.	3		13.4-13.8167		
15		Boring CC-2 was abandoned at -14.9' (MLLW) due to drill refusal.					
16							
17							
18							
19							
20							

*Test boring CC 2 located by COE and Battelle. Drilled 14:20 - 15:10, in 20' of water. *Estimated 6.6' above MLLW and corrected depths. (4" drill pipe)*

Sheet Fig. 4

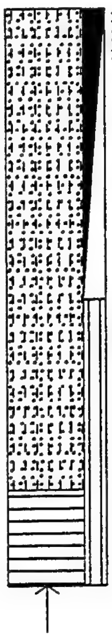
LACO ASSOCIATES

GEOTECHNICAL BORING LOG

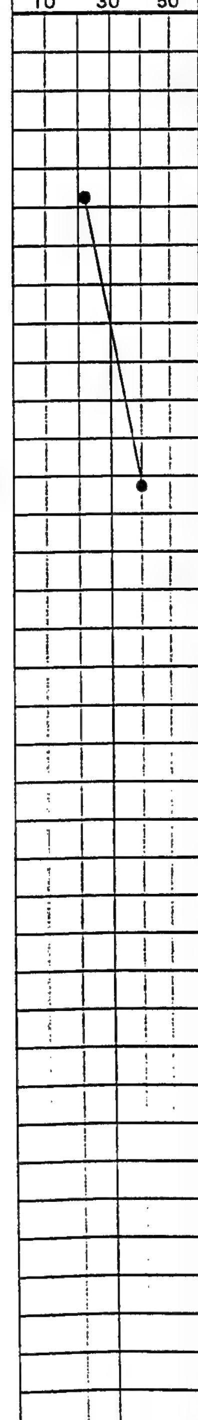
Boring No. CC 3

PROJECT: GEOTECHNICAL INVESTIGATION
PROJECT NO.: 4382
BORING LOCATION: CRESCENT CITY HARBOR CHANNEL
DATE: 9/18/96
DRILLING METHOD: DIEDRICH D-25 ROTARY on BARGE
ELEVATION: *
DRILLER: PC EXPLORATION, INC.
LOGGED BY: DNL
DEPTH TO WATER: INITIAL ▽ : NA **COMPLETION** ▼ : NA
SITE GEOLOGY: Recent sediments over bedrock of St. George Fm. and Franciscan Fm.

DEPTH FROM MLLW	SOIL SYMBOLS, SAMPLERS AND TEST DATA	Description	SAMPLER DIAMETER (inches)	Dry Density pcf	STANDARD PENETRATION TEST DEPTH	N
12	10/6 10/6 12/6	Harbor Bottom @ 15' below drilling barge (-12' MLLW).				
		Sand (SP-SM): very dark gray (5YR3/1w), fine to medium grained sand, dense, saturated, with abundant organic material and shell fragments, and odors of H2S.	3		12-13.5	22
13	15/6 15/6 25/6					
14			2		13.5-15	40
		Shale: bedrock, black, dense, fissile, highly fractured, with a lag deposit of coarse sand and gravel, shale weathered to clay at interface.				
15		Boring CC-3 abandoned at -15' (MLLW) due to encountering bedrock.				
16						
17						
18						
19						



CURVE



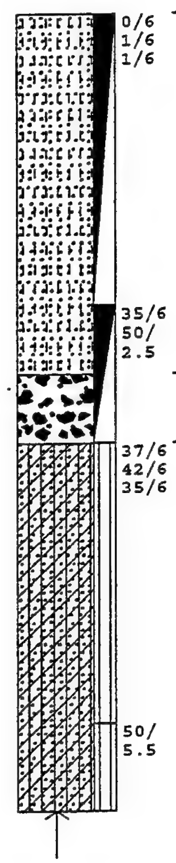
*Test boring CC 3 located by COE and Battelle. Drilled 10:32 - 12:00, in 15' of water. *Estimated 3.0' above MLLW and corrected depths. (4" drill pipe)*

Sheet Fig. 5

GEOTECHNICAL BORING LOG

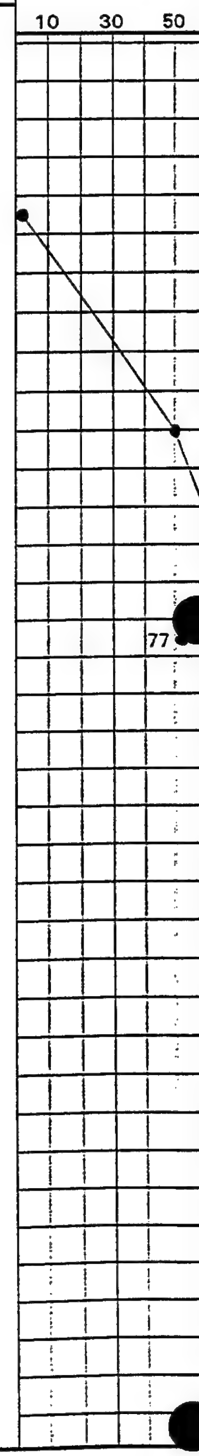
Boring No. CC 4

PROJECT: GEOTECHNICAL INVESTIGATION
PROJECT NO.: 4382
BORING LOCATION: CRESCENT CITY HARBOR CHANNEL
DATE: 9/18/96
DRILLING METHOD: DIEDRICH D-25 ROTARY on BARGE
ELEVATION: *
DRILLER: PC EXPLORATION, INC.
LOGGED BY: DNL
DEPTH TO WATER: INITIAL : NA **COMPLETION** : NA
SITE GEOLOGY: Recent sediments over bedrock of St. George Fm. and Franciscan Fm.



DEPTH FROM MLLW	Description	SAMPLER DIAMETER (inches)	Dry Density pcf	STANDARD PENETRATION TEST DEPTH	N
	Harbor Bottom @ 13.5' below drilling barge (-10.75' MLLW).				
11	Sand (SP-SM): very dark gray (5YR3/1w), fine to medium grained sand, very loose, saturated, with abundant organic material and common shell fragments, and pronounced odor of H2S.	3		10.75-12.25	2
12		3		12.25-12.9583	50
	Gravel (GW): dark gray, sandy gravel, dense, saturated, interpretted as a lag deposit at the base of recent harbor sediments.				
13	Sand (SM-SC): olive gray (5Y4/2w), fine to coarse grained sand, with silt and clay, very dense, friable, no organics or shell fragments, possibly Pleistocene marine terrace deposit or Plio-Pleistocene St. George Fm. sediments.	2		12.96-14.46	77
14		2		14.46-14.9183	
15	Boring CC-4 abandoned at -14.92' (MLLW), or 4.17' below harbor bottom, due to refusal of 2" split spoon in dense sand.				
16					
17					

CURVE



*Test boring CC 4 located by COE and Battelle. Drilled 08:45 - 10:00, in 13.5' of water. *Estimated 2.75' above MLLW and corrected depths. (4" drill pipe)*

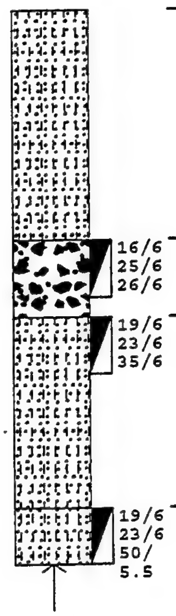
Sheet Fig. 6

LACO ASSOCIATES

GEOTECHNICAL BORING LOG

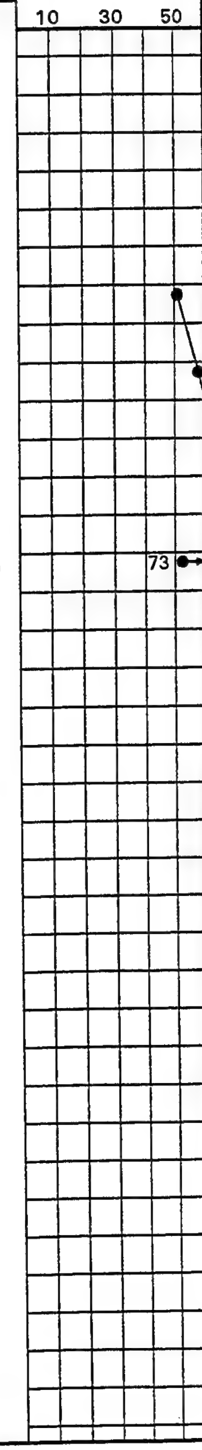
Boring No. CC 5

PROJECT: GEOTECHNICAL INVESTIGATION
PROJECT NO.: 4382
BORING LOCATION: CRESCENT CITY HARBOR CHANNEL
DATE: 9/17/96
DRILLING METHOD: DIEDRICH D-25 ROTARY on BARGE
ELEVATION: *
DRILLER: PC EXPLORATION, INC.
LOGGED BY: DNL
DEPTH TO WATER: INITIAL : NA **COMPLETION** : NA
SITE GEOLOGY: Recent sediments over bedrock of St. George Fm. and Franciscan Fm.



DEPTH FROM MLLW	SOIL SYMBOLS, SAMPLERS AND TEST DATA	Description	SAMPLER DIAMETER (inches)	Dry Density pcf	STANDARD PENETRATION TEST DEPTH	N
		Harbor Bottom @ 15' below drill barge (-8.5' MLLW).				
10		Sand (SP-SM): very dark gray (5YR3/1w), loose, saturated, fine to medium grained sand, with abundant organic material and common shell fragments, and strong H2S odors.				
15	16/6 25/6 26/6	Gravel (GW): dark gray, sandy, very dense, saturated, probable gravel lag deposit at base of recent harbor sediments.	3		14.5-16	51
	19/6 23/6 35/6	Sand (SP-SM): dark gray (5Y4/1w), fine to coarse sand with silt and fine gravel, very dense, saturated, no organics or shell fragments, probable Pleistocene marine terrace deposits or Plio-Pleistocene St. George Fm. sediment.	3		16.5-18	58
20	19/6 23/6 50/5.5	Sand (SP-SM): dark gray (5Y4/1w), predominantly fine grained silty sand with occasional fine gravel, very dense, saturated, increasingly gravely at bottom of sample, refusal probably at gravels. Boring CC-5 abandoned at -22.96' (MLLW) due to sampler refusal in dense sand or dense sandy gravel. Note: No samples collected in upper section (-8.5' to -14.5' MLLW) per directions from COE representative on site. Boring not in channel so samples of recent harbor sediments not necessary (per Frank Snitz).	3		21.5-22.9583	73
25						
30						
35						
40						
45						

STANDARD PENETRATION TEST — CURVE



*Test boring CC 5 located by COE and Battelle. Drilled 15:40-17:00; 15' of water. *Estimated +6.5' to MLLW; depths corrected. Log scale changed. (4" pipe)*

Sheet Fig. 7

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: FIG. 8
	location: CRESCENT CITY HARBOR	date: 09/27/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	CRESCENT CITY TIDES, SEPTEMBER, 1996	date:	

September 1996

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1 6:43 am 7:49 pm 6.6 2:44 0.9 8:43 7.3 2:59 0.4 9:29	**2** 6:44 am 7:48 pm 6.0 3:41 1.6 9:28 7.1 3:44 0.6 10:27	**3** 6:45 am 7:46 pm 5.5 4:45 2.3 10:18 6.7 4:34 0.8 11:30	**4** 6:46 am 7:44 pm 5.1 5:57 2.8 11:16 6.4 5:30	**5** 6:47 am 7:43 pm 1.0 12:39 5.0 7:18 3.2 12:26 6.1 6:34	**6** 6:48 am 7:41 pm 1.0 1:47 5.0 8:36 3.3 1:42 6.1 7:41	**7** 6:49 am 7:39 pm 0.9 2:49 5.2 9:32 3.1 2:48 6.1 8:42
8 6:50 am 7:37 pm 0.8 3:39 5.5 10:17 2.8 3:42 6.3 9:35	**9** 6:51 am 7:36 pm 0.7 4:22 5.7 10:51 2.5 4:26 6.4 10:21	**10** 6:52 am 7:34 pm 0.6 4:58 6.0 11:22 2.1 5:04 6.5 11:02	**11** 6:53 am 7:32 pm 0.6 5:31 6.2 11:50 1.8 5:40 6.6 11:40	**12** 6:54 am 7:31 pm 0.7 6:03 6.4 12:18 1.4 6:16	**13** 6:55 am 7:29 pm 6.6 12:18 0.8 6:32 6.6 12:46 1.2 6:51	**14** 6:56 am 7:27 pm 6.5 12:56 1.0 7:03 6.7 1:14 0.9 7:28
15 6:57 am 7:25 pm 6.3 1:35 1.3 7:34 6.8 1:44 0.8 8:07	**16** 6:58 am 7:24 pm 6.0 2:18 1.7 8:06 6.8 2:16 0.7 8:50	**17** 6:59 am 7:22 pm 5.7 3:05 2.1 8:43 6.8 2:52 0.6 9:39	**18** 7:01 am 7:20 pm 5.4 4:00 2.5 9:25 6.7 3:36 0.6 10:35	**19** 7:02 am 7:18 pm 5.2 5:07 2.9 10:19 6.6 4:29 0.6 11:40	**20** 7:03 am 7:17 pm 5.1 6:22 3.2 11:27 6.5 5:35	**21** 7:04 am 7:15 pm 0.5 12:50 5.3 7:38 3.1 12:48 6.5 6:49
22 7:05 am 7:13 pm Equinox 0.3 1:58 5.6 8:42 2.8 2:06 6.7 8:04	**23** 7:06 am 7:11 pm 0.1 2:58 6.1 9:33 2.2 3:13 6.9 9:12	**24** 7:07 am 7:10 pm 0.0 3:51 6.6 10:19 1.5 4:11 7.2 10:13	**25** 7:08 am 7:08 pm 0.0 4:39 7.1 11:00 0.8 5:02 7.3 11:08	**26** 7:09 am 7:06 pm 0.1 5:24 7.4 11:39 0.2 5:51	**27** 7:10 am 7:04 pm 7.3 12:01 0.4 6:07 7.7 12:18 -0.2 6:39	**28** 7:11 am 7:03 pm 7.1 12:52 0.8 6:49 7.7 12:57 -0.4 7:25
29 7:12 am 7:01 pm 6.8 1:43 1.3 7:31 7.6 1:36 -0.3 8:12	**30** 7:13 am 6:59 pm 6.4 2:34 1.8 8:13 7.3 2:16 -0.1 9:00					

Crescent City, CA *(41°44.7'N, 124°11.0'W)*

Attachment 1

Field Logs (copies)

11:40 AM
16' H2O

GEOTECHNICAL EXPLORATION BORING LOG

LACO ASSOCIATES consulting engineers 216 J Street, Eureka, California 95501 ● (707) 443-5054	project Crescent City Harbor	by DNL	sheet no 1/5
	location CC-1	date 9-17-98	
	client CORPS ENG.	checked	job no 4382
	140 Lb Hammer 30" drop	date	

HOLE NO. CC-1 LOGGED BY DNL DRILL RIG PC Exploration REVISED

HOLE ELEV. 16' H2O GROUNDWATER ELEV. ____ SAMPLER 3" S.Spoon / Shelby

5.1' Above MLLW

HOLE DIAMETER ____

MLLW	SOIL DESCRIPTION	WATER LEVEL	U.S.C.S.	DEPTH FT. 16' +	SAMPLE	BLOWS/FT.	WATER CONTENT	DRY UNIT WT. PCF	% PASS No. 200 SIEVE	POCKET PENETROM. PSF	TORVANE PSF	LAB MINIATURE VANE-PSF	LIQUID LIMIT	PLASTICITY INDEX
-11.0	SILTY SAND w/ ORGANIC MTL				NR 1									
-12	LOOSE WET FINE GRAIN'D			1	NR 2 / 1	CC-1 @ 1.5' ENTIRE SAMPLE TO FALLEN FROM Bottle								
13	5YR 3/1 very DARK GRAY			2										
14	QUICK-DILATANCY CLAM SHELL FRAGS			3	NR 18	DRILL REF @ ~3' below 2+1 ...								
-15	GRAVELY SAND DK GRAY LOOSE-MD			4	50	Drive 2" S-Spoon +								
16	FINE SILTY SAND STONE OLIVE 5Y5/4 w WEATHER'D DENSE FRACT'D w/ THIN CLAY CLASTS				50	(-4") Bedrx below bay								
				5		CC-1-2, 3-4.5'								
17				6										
18	Hole ABND @ 4.5' below Harbor			7										
19	Bottom - pulled			8										
20	up & MOVE TO CC-2			9										
				10										
				11										
				12										
				13										
				14										
				15										
				16										

KEY: SAMPLE: SACK JAR

DISTURBED

UNDISTURBED

WATER LEVEL

REMARKS:

GEOTECHNICAL EXPLORATION BORING LOG

LACO ASSOCIATES
consulting engineers
216 J Street, Eureka, California 95501 • (707) 443-5054

project: Crescent City Harbor	by: DNL	sheet no: 2/5	
location: CC-2	date: 9/17/96	job no: 4382	
client: CORPS - ENGINEERS	checked:		
	date:		

HOLE NO. CC-2 | LOGGED BY DNL | DRILL RIG PC Exploration | REVISED

HOLE ELEV. -20' | GROUNDWATER ~~ELEV.~~ Depth 20' | SAMPLER

HOLE DIAMETER

SOIL DESCRIPTION	WATER LEVEL	U.S.C.S.	DEPTH FT.	SAMPLE	BLOWS/FT.	WATER CONTENT %	DRY UNIT WT. PCF	% PASS No. 200 SIEVE	POCKET PENETROM. PSF	TORVANE PSF	LAB MINIATURE VANE-PSF	LIQUID LIMIT	PLASTICITY INDEX		
DARK GRAY SAND AS IN CC-1, LOOSE WET, WITH ORGANIC MTL, OCC SHELLS GRAVEL/COBBLES @ Shoe.				50	-5"	CC-2-1 @ 0-1'									
			21												
			22												
			23												
			24												
			25												
			26												
Set drill pipe on bottom, SET 3" Split Spoon & could only drive ~~8"~~ 5" on 50 blows			27												

KEY: SAMPLE: SACK | JAR
DISTURBED
UNDISTURBED
WATER LEVEL

REMARKS: WATER DEPTH: 20' 2:20 pm
6.6' above MLLW 20 - 6.5 = 13.4'

GEOTECHNICAL EXPLORATION BORING LOG

LACO ASSOCIATES
consulting engineers
216 J Street, Eureka, California 95501 • (707) 443-5054

project Cres City	by DNL	sheet no 3/5
location Harbor Channel	date 9/17/96	
client	checked	job no 4382
CC-5	date	

HOLE NO. CC-5
HOLE ELEV. -15' water
HOLE DIAMETER ____
LOGGED BY DNL
GROUNDWATER ELEV. ____
DRILL RIG PC Explor
SAMPLER S Spoon
REVISED

SOIL DESCRIPTION	WATER LEVEL	U.S.C.S.	DEPTH FT.	SAMPLE	BLOWS/FT.	WATER CONTENT %	DRY UNIT WT. PCF	% PASS No. 200 SIEVE	POCKET PENETROM. PSF	TORVANE PSF	LAB MINIATURE VANE-PSF	LIQUID LIMIT	PLASTICITY INDEX
SAND			16	1									
LOOSE SILT (SOFT)			17	2									
AS IN CC 1 & 2			18	3									
			19	4									
DK GRAY w/ SHELL FRAGS			20	5									
RX			21	6 / 16	CC-5-1: 21 to 22.5								
GRAY SD DENS RNDD COBBLES			22	7 / 25 / 26									
fine Sand dense wet 5Y4/1 W			23	8 / 19	CC 5-2: 23 to 24.5'								
DK GRAY well sorted fine sand w/ occ grls.			24	9 / 23 / 35									
			25	10									
			26	11									
			27	12									
			28	13 / 19	CC-5-3: 28'-29.5'								
FINE GRAY SAND SP-SM A/A DENSE WET w/ occ grvl			29	23 / 50									
Refusal			30		Refus 50/5.5"								

KEY: SAMPLE: SACK, JAR; DISTURBED; UNDISTURBED; WATER LEVEL

REMARKS: 15' H2O 3:40pm
OUT OF CHANNEL Drill to Refs
No SAMPLES SPT @ B-RX
PER F. SMITZ

GEOTECHNICAL EXPLORATION BORING LOG

LACO ASSOCIATES
consulting engineers
216 J Street, Eureka, California 95501 ● (707) 443-5054

project CCity Harbor
location " "
client COE
IN 13.5' H2O @ 8:45
by DM
date 9/18/96
checked
date
sheet no 4/5
job no 4382

HOLE NO. CC-4
HOLE ELEV. IN 13.5' H2O
HOLE DIAMETER
LOGGED BY DM
GROUNDWATER ELEV.
DRILL RIG PLEXO1
SAMPLER
REVISED

SOIL DESCRIPTION	WATER LEVEL	U.S.C.S.	DEPTH FT.	SAMPLE	BLOWS/FT.	WATER CONTENT %	DRY UNIT WT. PCF	% PASS No. 200 SIEVE	POCKET PENETROM. PSF	TORVANE PSF	LAB MINIATURE VANE-PSF	LIQUID LIMIT	PLASTICITY INDEX		
DARK GRAY - BLACK SAND, W/ BRN ORG. LOOSE WET, F-M SAND W/OCC SHELLS ~~SAND H2S ODOR~~			14	3, 1, 1, 35, 50, X		CC-4,1	13.5	-15						18.0 13.5 / 4.5	
			15		=2.5" 15'6.5	CC-4,2	15	15'-8.5"	~~15'~~		15.7'				
			16			37 42 35	15'8.5" 21.5'	1.5 - 2'		2 1/2"	(2.2') =				
GRAVEL STRINGER ??			17				2" S.SPOON		2.2 - 3.7				15.7 1.5		
OLIVE GRAY SAND 5Y4/2W FINE TO SILTY W/COARSE SAND			18	50	5.5"	2" SPOON							17.2 2.9 / 14.3		
DENSE FRIABLE NO ORG NO SHELLS			19												
			20								17.2 13.5 / 3.7				
			21										4.5	/ 6.0	
			22												
			23												
			24												

KEY: SAMPLE: SACK JAR
DISTURBED
UNDISTURBED
WATER LEVEL

REMARKS: 9/18 TIDE: LOW @ 9:42 -29 9:13 9:13 @ 2.
High @ 3:49 -32 3:17 3:17 @ 7.3'

GEOTECHNICAL EXPLORATION BORING LOG

LACO ASSOCIATES
consulting engineers
216 J Street, Eureka, California 95501 ● (707) 443-5054

project Crescent City Harbor	by		sheet no 5/5
location CC-3	date 9/13/96		
client Corps / Engineers	checked		job no 4382
	date		

HOLE NO. CC-3
HOLE ELEV. -15'
HOLE DIAMETER 10:32
LOGGED BY DM
GROUNDWATER ELEV. 15' H2O
DRILL RIG PC Explor
SAMPLER 3" Split Spoon
REVISED

SOIL DESCRIPTION	WATER LEVEL	U.S.C.S.	DEPTH FT.	SAMPLE	BLOWS/FT.	WATER CONTENT %	DRY UNIT WT. PCF	% PASS No. 200 SIEVE	POCKET PENETROM. PSF	TORVANE PSF	LAB MINIATURE VANE-PSF	LIQUID LIMIT	PLASTICITY INDEX
SAND BLACK TO DARK GRAY LOOSE WET Rich in OrG MTL W/ SHELL FRAGMENT STRONG H2S ODORS		SP/SM	16	10 / 10 / 12	3" Spoon ~6" Recov	CC-3-1: 15-16.5							
			17	15 / 15 / 25	3" Spoon	CC-3-2: 16.5-18.0'							
SHALE BEDROCK BLACK DENSE W/ GRAVEL @ TOP LAG DEPOSIT W/ COARSE SAND & COBL			18										
			19		Hole abond @ "refusal" in Bed rock								
			20										
			21										
			22										
			23										
			24										

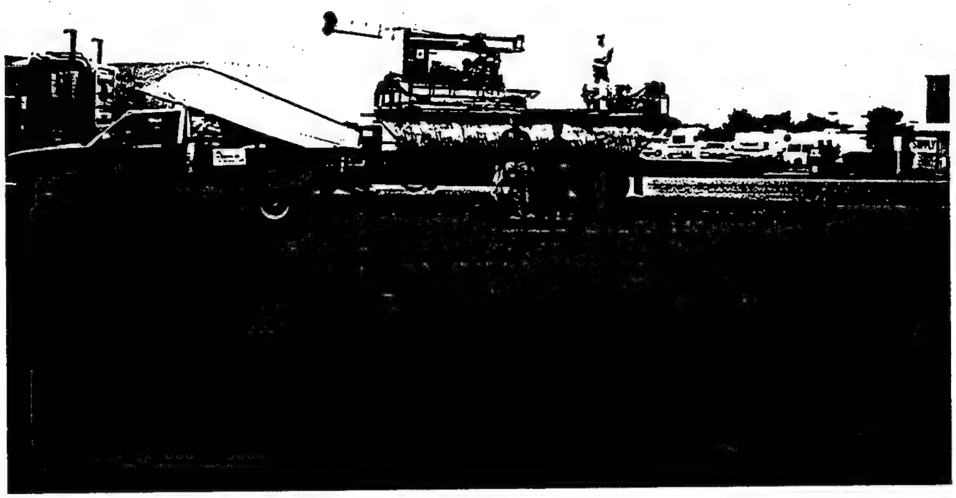
KEY: SAMPLE: SACK JAR
DISTURBED
UNDISTURBED
WATER LEVEL

REMARKS:

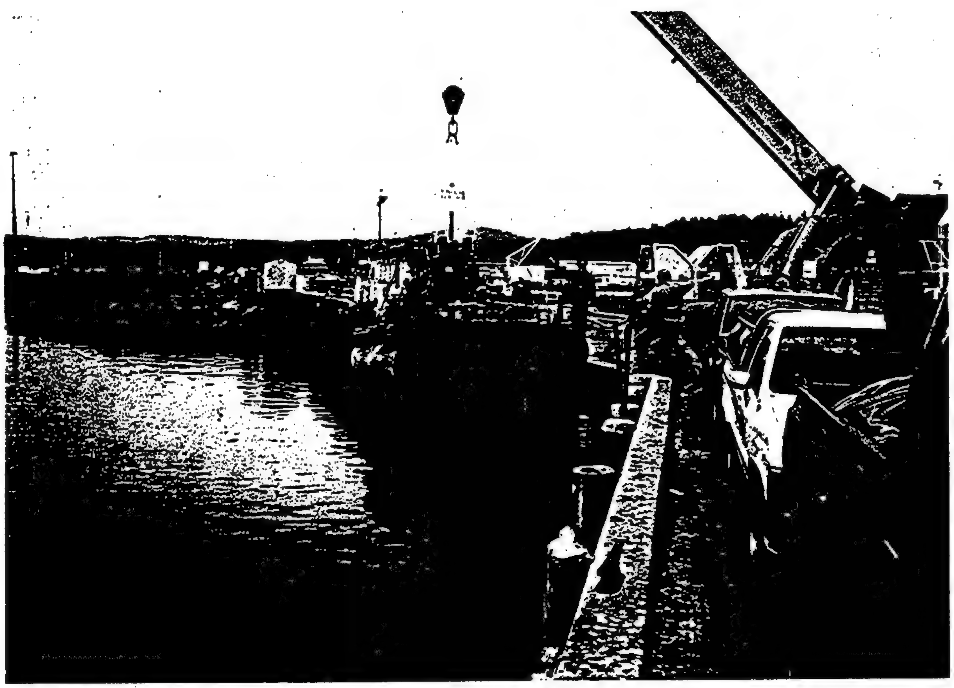
Attachment 2

Photographs from Field Investigation

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: SHEET 1
	location: CRESCENT CITY HARBOR	date: 10/02/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	PROJECT PHOTOGRAPHS	date:	

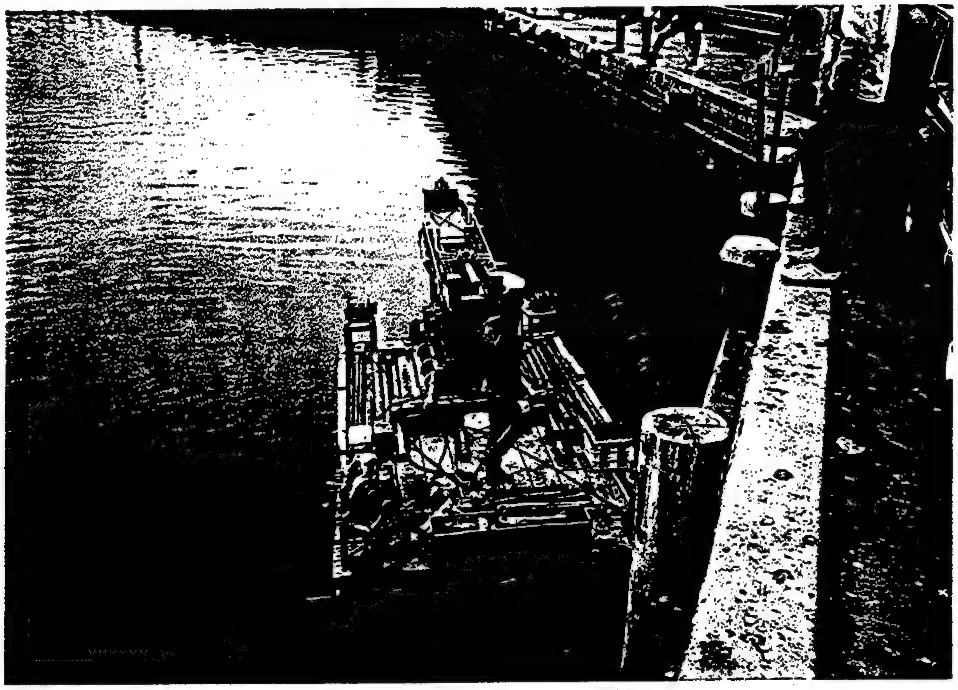


Photograph 1. The PC Exploration barge-mounted drill-rig arrived on the job site on a flat-bed truck. PC Exploration provided the small boat in the pickup in the foreground.

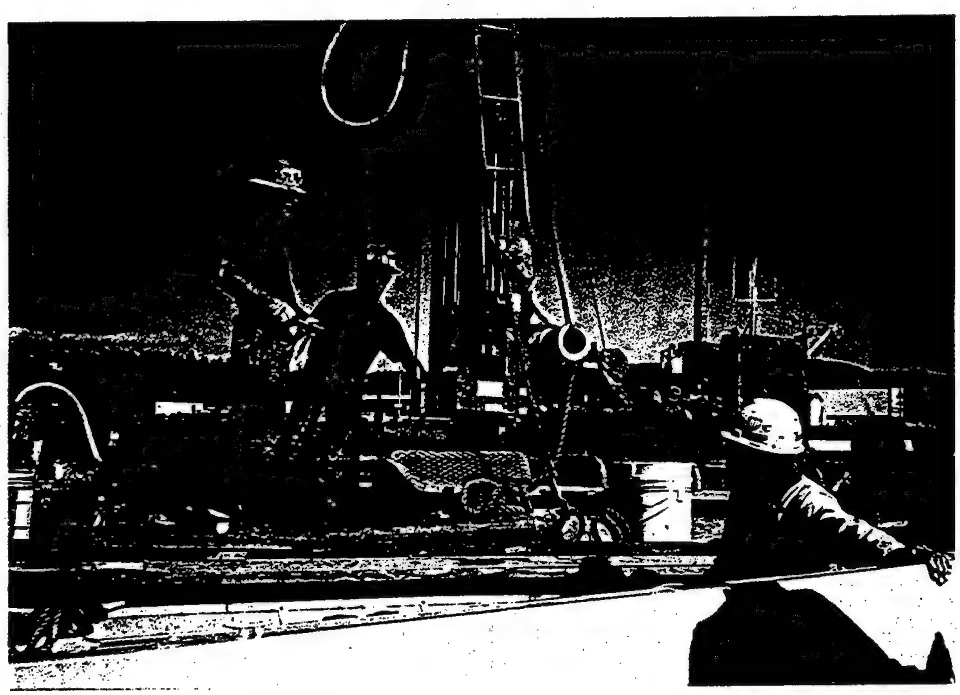


Photograph 2. The drill was lowered into the harbor by crane.

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: SHEET 2
	location: CRESCENT CITY HARBOR	date: 10/02/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	PROJECT PHOTOGRAPHS	date:	



Photograph 3. The drill-rig, with the mast lowered, as viewed from the Citizens' Dock in Crescent City harbor. Looking east.

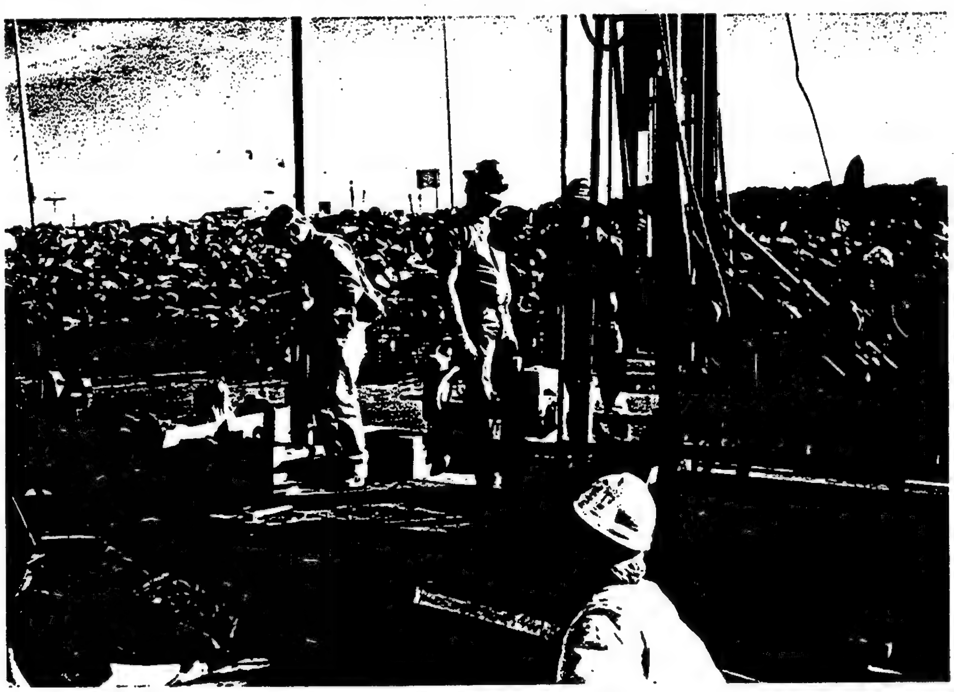


Photograph 4. Lowering the sampler into the drill pipe to collect a sample on CC 1, or CC 2.

LACO ASSOCIATES
CONSULTING ENGINEERS
216 J STREET EUREKA, CA 95501
(707) 443-5054

project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: SHEET 3
location: CRESCENT CITY HARBOR	date: 10/02/96	
client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
PROJECT PHOTOGRAPHS	date:	

Photograph 5. Positioning the drill-rig on the location of CC 4. The view is to the north east from the dock.



Photograph 6. Drill-rig on CC 4. Mr. Farley (Battelle) is checking the location with a range-finder.

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: SHEET 4
	location: CRESCENT CITY HARBOR	date: 10/02/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	PROJECT PHOTOGRAPHS	date:	

Photograph 7. The drill-rig at the dock after completion of drilling. The blue/white boat at left was loaned to the COE by the Crescent City Harbor District.

ATTACHMENT 3

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
LABORATORY
25 LIBERTY SHIP WAY, SAUSALITO, CALIFORNIA 94965-1768

REPLY TO
ATTENTION OF:

NOV 01 1996

CESPN-LB (1110-1-8100b)

MEMORANDUM FOR Commander, San Francisco District
ATTN: CESPN-PE-EG / Steven Chen

SUBJECT: Report of Materials Investigation, Crescent City Harbor Boring Deepening

1. Reference DD Form 448, Number E86 95 3028 dated 10 October 1996.

2. Attached test results were completed on subject projects.

3. Billing will be made by the Sacramento District Finance and Accounting Branch.

5. Significant Findings: None

Paul D. Hart
for EDWARD A. WYLIE
Director, SPD Laboratory

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: FIG. 2
	location: CRESCENT CITY HARBOR	date: 09/27/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	SITE MAP: BORING LOCATIONS (approx.)	date:	

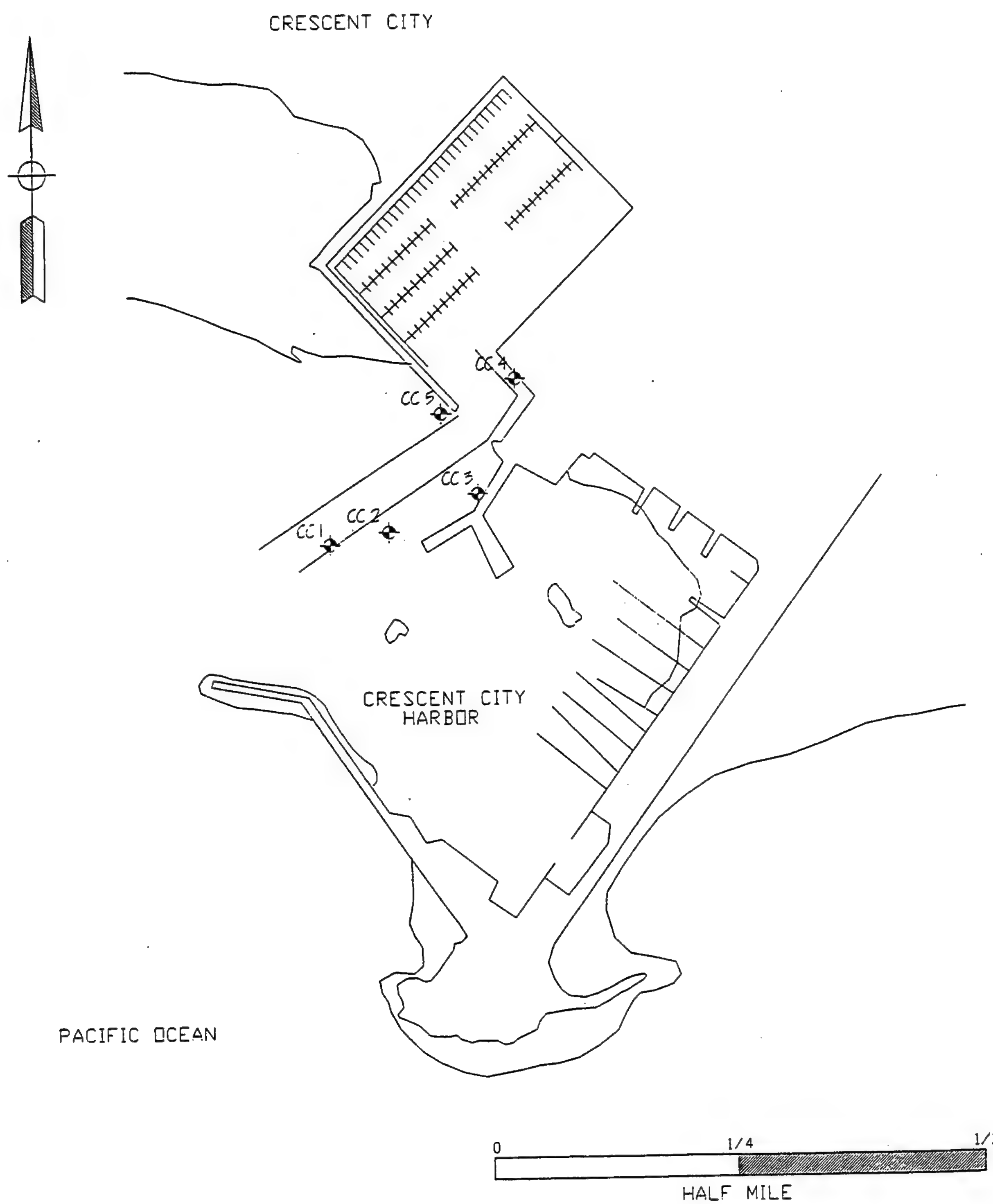


PLATE A

U.S. ARMY CORPS OF ENGINEERS, SOUTH PACIFIC DIVISION LABORATORY, SAUSALITO, CALIFORNIA

SOIL TEST RESULT SUMMARY

PROJECT: Crescent City Harbor Channel Deepening DATE: October 1996

Division Number	Hole Number	Field Sample No.	Depth or Elevation From	Depth or Elevation To	Laboratory Descriptive Classification	GRAVEL PERCENT FINER 12.0	6.0	3.0	1.5	3/4	3/8	#4	SAND #8	#16	#30	#50	#100	FINE #200	Liquid Limit	Plastic Index	Specifi Gravity +4 -4	Chunk Density	Water Content %
124904	CC-1	2	14.5										100	99	99	99	98	95				83.62 66.24	
124905	CC-2	1	13.4					100	51	35	23	15	13	10	9	8	7	5				152.88 147.03	*
124906	CC-3	1	12.0					100	68	68	67	64	61	58	56	53	44	25				97.84 58.51	
124911	CC-4	3	13.0						100	77	64	53	48	43	41	35	24	9				117.23 101.21	
124913	CC-5	1	14.5						100	74	62	55	49	45	42	40	27	11					*
124915	CC-5	3	21.5						100	96	92	91	90	89	88	84	49	25				124.01 105.12	

* CC-2 This sample was loose rocks.
* CC-5 This sample was too disturbed to get a meaningful density.

ATTACHMENT 4

CRESCENT CITY HARBOR

SEAFLOOR CHARACTERIZATION STUDY
Physical & Chemical Characteristics

For

U.S. ARMY CORPS OF ENGINEERS
San Francisco District

By

Battelle Marine Science Laboratory
Sequim, Washington

December 1996

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

GRAIN SIZE, TOTAL SOLIDS, AND TOTAL ORGANIC CARBON

Sample ID	Replicate	% Gravel >2.0 mm	% Sand 2.0-0.063 mm	% Silt 0.063-0.004 mm	% Clay <0.004 mm	Solids (%)	TOC (%)
CC1 + CC3	1	12	57	23	8	57	4.80
CC1 + CC3	2	12	58	22	8	57	--
CC2		2	45	40	13	47	9.50
CC4		1	70	20	9	43	12.8

QC ANALYSES: GRAIN SIZE AND TOTAL SOLIDS

	% Gravel	% Sand	% Silt	% Clay	Solids (%)
Replicate Analysis					
CC1 + CC3	12	57	23	8	57
CC1 + CC3	12	58	22	8	57
RPD (%)	0	2	4	0	0

QC ANALYSES: TOC

	TOC (%)
Replicate Analysis	
1101[a]	0.07
1101[a]	0.07
RPD (%)	0
1107[a]	12.81
1107[a]	12.33
RPD (%)	4
SRM	
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.95
SRM Theoretical Value	4.80
PD (%)	3

a = Sample ID number used for QC purposes only; not a client sample ID number.

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U.S. Army Corps of Engineers, San Francisco District

GRAIN SIZE, TOTAL SOLIDS, AND TOTAL ORGANIC CARBON

Sample ID	Replicate	% Gravel >2.0 mm	% Sand 2.0-0.063 mm	% Silt 0.063-0.004 mm	% Clay <0.004 mm	Solids (%)	TOC (%)
CC1 + CC3	1	12	57	23	8	57	4.80
CC1 + CC3	2	12	58	22	8	57	--
CC2		2	45	40	13	47	9.50
CC4		1	70	20	9	43	12.8

QC ANALYSES: GRAIN SIZE AND TOTAL SOLIDS

Replicate Analysis

	% Gravel	% Sand	% Silt	% Clay	Solids
CC1 + CC3	12	57	23	8	57
CC1 + CC3	12	58	22	8	57
RPD (%)	0	2	4	0	0

QC ANALYSES: TOC

Replicate Analysis

	TOC
1101[a]	0.07
1101[a]	0.07
RPD (%)	0
1107[a]	12.81
1107[a]	12.33
RPD (%)	4

SRM

	TOC
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.95
SRM Theoretical Value	4.80
PD (%)	3

a = Sample ID number used for QC purposes only; not a client sample ID number.

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

METALS IN SEDIMENT SAMPLES
(concentrations in µg/g dry weight - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag GFAA	As XRF	Cd GFAA	Cr XRF	Cu XRF	Pb XRF	Ni XRF	Se GFAA	Zn XRF
1019CC*4		CC1 + CC3	0.147	0.112	8.1	0.55	328	42.8	39.1	157	0.28	119
1019CC*5		CC2	0.120	0.133	9.3	0.70	326	45.2	12.3	181	0.46	108
1019CC*6	1	CC4	0.102	0.103	10.3	0.55	416	49.5	8.5	177	0.46	112
1019CC*6	2	CC4	0.276	0.103	NA	0.65	NA	NA	NA	NA	0.37	NA
Blank			0.0166	0.011	NA	0.021 U	NA	NA	NA	NA	0.16 U	NA
Detection Limits			0.0017	0.005	NA	0.021	NA	NA	NA	NA	0.16	NA
STANDARD REFERENCE MATERIAL												
PACS-1			4.97	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	4.57									
		range	±0.16									
		percent difference	9%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BEST			0.0854	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	0.092									
		range	±0.009									
		percent difference	7%	NA	NA	NA	NA	NA	NA	NA	NA	NA
1646			NA	0.114	12.6	0.30	84	17.9	27.5	29.7	0.46	137
		certified value		NC	11.6	0.36	76	18	28.2	32	0.6 NC	138
		range			±1.3	±0.07	±3	±3	±1.8	±3		±6
		percent difference	NA	NA	9%	17%	11%	1%	2%	7%	23%	1%

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U.S. Army Corps of Engineers, San Francisco District

METALS IN SEDIMENT SAMPLES
(concentrations in µg/g dry weight - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag GFAA	As XRF	Cd GFAA	Cr XRF	Cu XRF	Pb XRF	Ni XRF	Se GFAA	Zn XRF
MATRIX SPIKE RESULTS												
Amount Spiked			2.00	2.00	NS	2.00	NS	NS	NS	NS	2.00	NS
1019CC*6	mean		0.189	0.103	NS	0.60	NS	NS	NS	NS	0.42	NS
1019CC*6 + SPK			2.07	2.25	NS	2.99	NS	NS	NS	NS	1.99	NS
Amount Recovered			1.88	2.15	NS	2.39	NS	NS	NS	NS	1.57	NS
Percent Recovery			94%	107%	NS	120%	NS	NS	NS	NS	79%	NS
REPLICATE ANALYSIS RESULTS												
1019CC*6	1	CC4	0.102	0.103	10.3	0.55	416	49.5	8.5	177	0.46	112
1019CC*6	2	CC4	0.276	0.103	NA	0.65	NA	NA	NA	NA	0.37	NA
		RPD	92% #	0%	NA	17%	NA	NA	NA	NA	22%	NA

U Not detected at or above DL shown
NA Not applicable/available
NC Not certified
NS Not spiked
\# Outside replicate QC precision (±25%)

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

METALS IN ELUTRIATE SAMPLES
(concentrations in µg/L - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag ICP-MS	As ICP-MS	Cd ICP-MS	Cr ICP-MS	Cu ICP-MS	Pb ICP-MS	Ni ICP-MS	Se ICP-MS	Zn CP-MS
1019CC*1		CC1 + CC3	0.00316	0.0326	1.36	0.0317	1.02	2.13	0.253	3.41	0.305	2.69
1019CC*2		CC2	0.00371	0.454	1.49	0.0718	1.46	1.49	0.724	2.75	0.3 U	2.08
1019CC*3	1	CC4	0.00187	0.01 U	2.55	0.0173	0.862	2.30	0.185	2.14	0.3 U	7.62
1019CC*3	2	CC4	0.00193	0.0932	2.78	0.0194	1.24	2.12	0.169	1.93	0.538	3.80
1019CC*7		Control	0.000672	0.513	1.41	0.0727	0.278	1.25	0.0201	2.48	0.3 U	2.48
Blank			0.000118	0.0668	0.1 U	0.01 U	0.0683	0.03 U	0.01 U	0.03 U	0.3 U	2.12
Detection Limits			0.000056	0.01	0.1	0.01	0.03	0.03	0.01	0.03	0.3	0.2
STANDARD REFERENCE MATERIAL												
1641c			1510	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	1470									
		range	±40									
		percent difference	3%	NA	NA	NA	NA	NA	NA	NA	NA	NA
1643d			NA	1.14	59.1	5.94	19.7	20.4	19.0	55.7	10.6	76.9
		certified value		1.27	56.0	6.47	18.5	20.5	18.2	58.1	11.4	72.5
		range		±0.057	±0.73	±0.37	±0.20	±3.8	±0.64	±2.7	±0.17	±0.65
		percent difference	NA	10%	6%	8%	6%	0%	4%	4%	7%	6%

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U.S. Army Corps of Engineers, San Francisco District

METALS IN ELUTRIATE SAMPLES
(concentrations in µg/L - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag ICP-MS	As ICP-MS	Cd ICP-MS	Cr ICP-MS	Cu ICP-MS	Pb ICP-MS	Ni ICP-MS	Se ICP-MS	Zn CP-MS
BLANK SPIKE RESULTS												
Amount Spiked			0.0132	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Blank			0.000118	0.0668	0.1 U	0.01 U	0.0683	0.03 U	0.01 U	0.03 U	0.3 U	2.12
Blank + SPK			0.0135	1.85	1.40	1.15	1.88	1.76	1.43	1.26	1.40	4.47
Amount Recovered			0.0134	1.78	1.40	1.15	1.81	1.76	1.43	1.26	1.40	2.35
Percent Recovery			101%	89%	70% &	58% &	91%	88%	72% &	63% &	70% &	118%
MATRIX SPIKE RESULTS												
Amount Spiked			0.0135	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1019CC*3			0.00190	0.01 U	2.67	0.0184	0.983	2.21	0.177	2.04	0.419	3.59
1019CC*3 + SPK			0.0154	0.759	4.46	0.949	3.57	4.27	1.29	3.26	2.36	5.32
Amount Recovered			0.0135	0.749	1.80	0.931	2.59	2.06	1.11	1.23	1.94	1.73
Percent Recovery			100%	37% &	90%	47% &	129% &	103%	56% &	61% &	97%	87%
REPLICATE ANALYSIS RESULTS												
1019CC*3	1	CC4	0.00187	0.01 U	2.55	0.0173	0.862	2.30	0.185	2.14	0.3 U	7.62
1019CC*3	2	CC4	0.00193	0.0932	2.78	0.0194	1.24	2.12	0.169	1.93	0.538	3.80
		RPD	3%	NA	9%	11%	36% #	8%	9%	10%	NA	67% #

U Not detected at or above DL shown
NA Not applicable/available
NC Not certified
NS Not spiked
\# Outside replicate QC precision (±25%)
& Outside spike recovery limit (±25)

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

CHLORINATED PESTICIDES AND PCBs IN SEDIMENT SAMPLES

(CF#1019)

MSL ID	1019CC*4	1019CC*5	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	1	2	1
Wet Wt.	22.54	20.19	21.50	22.03
Units (Dry Weight)	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	56.4	34.1	34.1	30.8
Batch	1	1	1	1
alpha-BHC	0.32 U	0.58 U	0.54 U	0.59 U
gamma-BHC	0.22 U	0.40 U	0.38 U	0.41 U
Heptachlor	0.07 U	0.12 U	0.11 U	0.12 U
Aldrin	0.68	0.60	1.22	1.68
beta-BHC	0.32 U	0.58 U	0.54 U	0.59 U
delta-BHC	0.32 U	0.58 U	0.54 U	0.59 U
Heptachlor Epoxide	0.31 U	0.57 U	0.53 U	0.58 U
Endosulfan I	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDE	3.44	2.47	2.44	2.03
Dieldrin	0.21 U	0.38 U	0.36 U	0.39 U
Endrin	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDD	0.26 U	0.48 U	0.45 U	0.49 U
Endosulfan II	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDT	0.74 U	1.36 U	1.28 U	1.38 U
Endrin Aldehyde	0.32 U	0.58 U	0.54 U	0.59 U
Endosulfan Sulfate	0.22 U	0.40 U	0.38 U	0.41 U
Chlordane	0.79 U	0.53 U	0.50 U	0.44 U
Toxaphene	0.71 U	0.48 U	0.45 U	0.39 U
Aroclor 1242	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1248	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1254	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1260	0.79 U	0.53 U	0.50 U	0.44 U
Surrogate Recoveries (%)				
PCB 103 (SIS)	76	37	71	72
PCB 198 (SIS)	80	27	56	88

U = Not detected at or above MDL. * = Outside Quality Control Limit.
NA = Not applicable.
NS = Not spiked.

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U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: CHLORINATED PESTICIDES AND PCBS IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike Amount*	*Percent Recovery*	1019-BSB	*Spike Amount*	*Percent Recovery*	RPD
Client ID	Blank	Blank Spike A			Blank Spike B			
Matrix	SED	SED	SED		SED			
Analytical Replicate	1	1	1		2			
Wet Wt.	21.6	21.6			21.6			
Units (Dry Weight)	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	%
Percent Dry Wt. (%)	38.9	38.9		NA	38.9	NA	NA	
Batch	1	1	1	1	1	1	1	
alpha-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
gamma-BHC	0.34 U	1.95	3.10	63	1.91	3.10	62	2
Heptachlor	0.10 U	2.60	3.10	84	2.59	3.10	84	0
Aldrin	0.33 U	3.01	3.10	97	2.78	3.10	90	8
beta-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
delta-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
Heptachlor Epoxide	0.49 U	0.49 U	NS	NA	0.49 U	NS	NA	NA
Endosulfan I	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
4,4'-DDE	0.23 U	1.97	NS	NA	2.01	NS	NA	NA
Dieldrin	0.33 U	5.20	6.20	84	5.04	6.20	81	3
Endrin	0.50 U	5.86	6.20	95	5.79	6.20	93	1
4,4'-DDD	0.41 U	0.41 U	NS	NA	0.41 U	NS	NA	NA
Endosulfan II	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
4,4'-DDT	1.16 U	6.20	6.20	100	6.06	6.20	98	2
Endrin Aldehyde	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
Endosulfan Sulfate	0.34 U	0.34 U	NS	NA	0.34 U	NS	NA	NA
Chlordane	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Toxaphene	0.51 U	0.51 U	NS	NA	0.51 U	NS	NA	NA
Aroclor 1242	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Aroclor 1248	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Aroclor 1254	0.57 U	68.7	62.0	111	69.0	62.0	111	0
Aroclor 1260	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Surrogate Recoveries (%)								
PCB 103 (SIS)	74	106			88			
PCB 198 (SIS)	74	96			86			

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QC ANALYSES: CHLORINATED PESTICIDES AND PCBs IN SEDIMENT SAMPLES

(CF#1019)		*Matrix Spike*			*SRM*	
MSL ID	1019-MSA	*Spike*	*Percent*	SRM 1941a	*Certified*	*Percent*
Client ID	Spike A	*Amount*	*Recovery*		*Value*	*Difference*
Matrix	SED			SED	SED	SED
Analytical Replicate	1			1		
Wet Wt.	21.3			5.16		
Units (Dry Weight)	ng/g	ng/g	%	ng/g	ng/g	%
Percent Dry Wt. (%)	56.4	NA	NA		NA	NA
Batch	1	1	1	1	1	1
alpha-BHC	0.33 U	NS	NA	0.78 U	NA	NA
gamma-BHC	1.30	2.08	62	0.54 U	NA	NA
Heptachlor	2.06	2.08	99	0.16 U	NA	NA
Aldrin	2.47	2.08	86	8.00	NA	NA
beta-BHC	0.33 U	NS	NA	0.78 U	NA	NA
delta-BHC	0.33 U	NS	NA	0.78 U	NA	NA
Heptachlor Epoxide	0.33 U	NS	NA	0.76 U	NA	NA
Endosulfan I	0.33 U	NS	NA	0.78 U	NA	NA
4,4'-DDE	2.96	NS	NA	16.1	6.59	245 *
Dieldrin	4.82	4.15	116	0.51 U	NA	NA
Endrin	4.16	4.15	100	1.01	NA	NA
4,4'-DDD	0.28 U	NS	NA	5.85	5.06	116
Endosulfan II	0.33 U	NS	NA	0.78 U	NA	NA
4,4'-DDT	4.16	4.15	100	1.82 U	NA	NA
Endrin Aldehyde	0.33 U	NS	NA	0.78 U	NA	NA
Endosulfan Sulfate	0.23 U	NS	NA	2.12	NA	NA
Chlordane	0.84 U	NS	NA	6.13 U	NA	NA
Toxaphene	0.75 U	NS	NA	5.47 U	NA	NA
Aroclor 1242	0.84 U	NS	NA	6.13 U	NA	NA
Aroclor 1248	0.84 U	NS	NA	6.13 U	NA	NA
Aroclor 1254	49.8	41.5	104	6.13 U	NA	NA
Aroclor 1260	0.84 U	NS	NA	6.13 U	NA	NA
Surrogate Recoveries (%)						
PCB 103 (SIS)	72			42		
PCB 198 (SIS)	55			34		

U = Not detected at or above MDL.
* = Outside Quality Control Limit. Interference with 4,4'-DDE peak on both analytical column and confirmatory column.
NS = Not spiked.
NA = Not applicable.

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

(CF#1019) **CHLORINATED PESTICIDES AND PCBs IN ELUTRIATE SAMPLES**

MSL ID	1019CC*1	1019CC*2	1019CC*2	1019CC*3	1019CC*7
Client ID	CC1 + CC3	CC2	CC2	CC4	Control
Matrix	Elutriate	Elutriate	Elutriate	Elutriate	Elutriate
Analytical Replicate	1	1	2	1	1
Volume extracted (mL)	300	300	300	250	300
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Batch	1	1	1	1	1
alpha-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
gamma-BHC	1.48 U	1.48 U	1.48 U	1.78 U	1.48 U
Heptachlor	1.66 U	1.66 U	1.66 U	2.00 U	1.66 U
Aldrin	1.37 U	1.37 U	1.37 U	1.65 U	1.37 U
beta-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
delta-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Heptachlor Epoxide	0.39 U	0.39 U	0.39 U	0.47 U	0.39 U
Endosulfan I	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDE	0.98 U	0.98 U	0.98 U	1.18 U	0.98 U
Dieldrin	0.44 U	0.44 U	0.44 U	0.53 U	0.44 U
Endrin	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDD	2.66	1.59 U	1.59 U	1.91 U	1.59 U
Endosulfan II	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDT	1.43 U	1.43 U	1.43 U	1.71 U	1.43 U
Endrin Aldehyde	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Endosulfan Sulfate	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Chlordane	105 U	105 U	105 U	127 U	105 U
Toxaphene	94.0 U	94.0 U	94.0 U	113 U	94.0 U
Aroclor 1242	105 U	105 U	105 U	127 U	105 U
Aroclor 1248	105 U	105 U	105 U	127 U	105 U
Aroclor 1254	105 U	105 U	105 U	127 U	105 U
Aroclor 1260	105 U	105 U	105 U	127 U	105 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	90	88	86	44	76
PCB 198 (SIS)	100	95	90	51	87

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BATTELLE MARINE SCIENCES LABORATORY
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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: CHLORINATED PESTICIDES AND PCBs IN ELUTRIATE SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike Amount*	*Percent Recovery*	1019-BSB	*Spike Amount*	*Percent Recovery*	RPD
Client ID	Blank	Blank Spike A			Blank Spike B			
Matrix	Elutriate	Elutriate			Elutriate			
Analytical Replicate	1	1			1			
Volume extracted (mL)	300	300			300			
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%	%
Batch	1	1			1			
alpha-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
gamma-BHC	1.48 U	11.9	16.7	71	10.8	16.7	65	10
Heptachlor	1.66 U	15.0	16.7	90	15.4	16.7	92	2
Aldrin	1.37 U	15.4	16.7	92	15.2	16.7	92	1
beta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
delta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
Heptachlor Epoxide	0.39 U	0.39 U	NS	NA	0.39 U	NS	NA	NA
Endosulfan I	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
4,4'-DDE	0.98 U	52.3	NS	NA	21.3	NS	NA	NA
Dieldrin	0.44 U	37.7	33.3	113	29.6	33.3	89	24
Endrin	1.64 U	34.2	33.3	103	30.8	33.3	92	11
4,4'-DDD	1.59 U	1.59 U	NS	NA	1.59 U	NS	NA	NA
Endosulfan II	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
4,4'-DDT	1.43 U	37.1	33.3	111	33.0	33.3	99	12
Endrin Aldehyde	1.64 U	1.64 U	NS	NA	3.30	NS	NA	NA
Endosulfan Sulfate	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
Chlordane	105 U	105 U	NS	NA	105 U	NS	NA	NA
Toxaphene	94.0 U	94.0 U	NS	NA	94.0 U	NS	NA	NA
Aroclor 1242	105 U	105 U	NS	NA	105 U	NS	VV	NA
Aroclor 1248	105 U	105 U	NS	NA	105 U	NS	NA	NA
Aroclor 1254	105 U	451	333	136	105 U	333	123	10
Aroclor 1260	105 U	105 U	NS	NA	105 U	NS	NA	NA
Surrogate Recoveries (%)								
PCB 103 (SIS)	77	113			121			
PCB 198 (SIS)	95	154			164			

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: CHLORINATED PESTICIDES AND PCBs IN ELUTRIATE SAMPLES

(CF#1019)		*Matrix Spike*			*Replicate Analysis*			
MSL ID	1019CC*1	1019CC*1-MSA	*Spike*	*Percent*	1019CC*2	1019CC*2	Mean	RPD
Client ID	CC1 + CC3	Matrix Spike A	*Amount*	*Recovery*	CC2	CC2		
Matrix	Elutriate	Elutriate			Elutriate	Elutriate		
Analytical Replicate	1	1			1	2		
Volume extracted (mL)	300	300			300	300		
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	ng/L	%
Batch	1	1			1	1		
alpha-BHC	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
gamma-BHC	1.48 U	14.0	16.7	84	1.48 U	1.48 U	NA	NA
Heptachlor	1.66 U	15.6	16.7	93	1.66 U	1.66 U	NA	NA
Aldrin	1.37 U	15.4	16.7	93	1.37 U	1.37 U	NA	NA
beta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
delta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
Heptachlor Epoxide	0.39 U	0.39 U	NS	NA	0.39 U	0.39 U	NA	NA
Endosulfan I	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
4,4'-DDE	0.98 U	16.3	NS	NA	0.98 U	0.98 U	NA	NA
Dieldrin	0.44 U	31.2	33.3	94	0.44 U	0.44 U	NA	NA
Endrin	1.64 U	35.9	33.3	108	1.64 U	1.64 U	NA	NA
4,4'-DDD	2.66	2.55	NS	NA	1.59 U	1.59 U	NA	NA
Endosulfan II	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
4,4'-DDT	1.43 U	28.1	33.3	84	1.43 U	1.43 U	NA	NA
Endrin Aldehyde	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
Endosulfan Sulfate	1.64 U	1.64 U	NS	NA	1.64 U	1.64 U	NA	NA
Chlordane	105 U	105 U	NS	NA	105 U	105 U	NA	NA
Toxaphene	94.0 U	94.0 U	NS	NA	94.0 U	94.0 U	NA	NA
Aroclor 1242	105 U	105 U	NS	NA	105 U	105 U	NA	NA
Aroclor 1248	105 U	105 U	NS	NA	105 U	105 U	NA	NA
Aroclor 1254	386	105 U	333	116	105 U	105 U	NA	NA
Aroclor 1260	105 U	105 U	NS	NA	105 U	105 U	NA	NA
Surrogate Recoveries (%)								
PCB 103 (SIS)	90	87			88	86		
PCB 198 (SIS)	100	93			95	90		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

(CF#1019) **PAHs IN SEDIMENT SAMPLES**

MSL ID	1019CC*4	1019CC*5	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC2	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	1	2	1
Wet Wt.	22.54	20.19	21.50	22.03
Units (Dry Weight)	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	56.4	34.1	34.1	30.8
Batch	1	1	1	1
1,4 Dichlorobenzene	2.23 U	4.10 U	10.2	4.15 U
Naphthalene	45.9	48.5	61.8	90.7
Acenaphthylene	3.86	5.69	5.68	6.06
Acenaphthene	22.7	10.4	11.8	22.9
Fluorene	31.3	22.8	26.3	37.5
Dibenzothiophene	12.5	10.0	13.7	22.3
Phenanthrene	79.4	63.4	98.1	152
Anthracene	34.9	34.2	32.5	40.2
Fluoranthene	154	107	158	286
Pyrene	211	173	204	234
Benzo[a]anthracene	52.9	43.7	52.3	86.8
Chrysene	79.4	59.0	83.7	126
Benzo[b]fluoranthene	80.4	86.3	93.5	137
Benzo[k]fluoranthene	33.5	31.5	34.9	50.3
Benzo[e]pyrene	41.8	46.8	51.4	80.7
Benzo[a]pyrene	45.3	48.9	49.2	77.3
Perylene	67.4	95.2	104	66.8
Indeno[1,2,3-c,d]pyrene	25.3	31.6	28.6	45.6
Dibenz[a,h]anthracene	6.77	7.13	7.51	11.9
Benzo[g,h,i]perylene	28.9	38.9	35.7	58.8
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	51	29	57	64
d8 Naphthalene	65	35	69	74
d10 Acenaphthene	67	32	71	79
d10 Phenanthrene	80	39	75	84
d12 Chrysene	82	40	69	76
d12 Perylene	72	34	62	70
d14 Dibenzo[a,h]anthracene	79	38	68	77

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike Amount*	*Percent Recovery*	1019-BSB	*Spike Amount*	*Percent Recovery*	RPD
Client ID	Blank	Blank Spike A			Blank Spike B			
Matrix	SED	SED	SED		SED			
Analytical Replicate	1	1	1		2			
Wet Wt.								
Units (Dry Weight)	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	%
Percent Dry Wt. (%)				NA		NA	NA	
Batch	1	1	1	1	1	1	1	
	1019S-BLK	1019S-BSA			1019S-BSB			
1,4 Dichlorobenzene	3.11 U	3.11 U	NS	NA	3.11 U	NS	NA	NA
Naphthalene	3.11 U	27.9	27.5	101	27.4	27.5	100	1.25
Acenaphthylene	3.30 U	25.2	27.5	92	25.5	27.5	93	0.81
Acenaphthene	2.96 U	26.9	27.5	98	26.0	27.5	95	2.38
Fluorene	5.89 U	27.6	27.5	100	23.6	27.5	86	10.9
Dibenzothiophene	1.10 U	1.10 U	NS	NA	1.10 U	NS	NA	NA
Phenanthrene	6.96 U	32.0	27.5	116	33.0	27.5	120	2.20
Anthracene	8.46 U	22.5	27.5	82	21.8	27.5	79	1.95
Fluoranthene	3.20 U	26.3	27.5	96	25.0	27.5	91	3.69
Pyrene	2.38 U	27.6	27.5	100	25.8	27.5	94	4.66
Benzo[a]anthracene	1.16 U	23.7	27.5	86	23.2	27.5	84	1.48
Chrysene	1.29 U	28.4	27.5	103	27.8	27.5	101	1.33
Benzo[b]fluoranthene	2.44 U	33.8	27.5	123	31.9	27.5	116	4.05
Benzo[k]fluoranthene	4.13 U	24.9	27.5	127	32.5	27.5	118	4.91
Benzo[e]pyrene	2.70 U	2.70 U	NA	NA	2.70 U	NA	NA	NA
Benzo[a]pyrene	3.22 U	30.0	27.5	109	30.2	27.5	110	0.31
Perylene	28.8 U	28.8 U	NA	NA	28.8 U	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	1.48 U	27.9	27.5	102	27.7	27.5	101	0.59
Dibenz[a,h]anthracene	1.87 U	28.6	27.5	104	29.2	27.5	106	1.49
Benzo[g,h,i]perylene	1.35 U	27.4	27.5	98	27.0	27.5	98	0.91
Surrogate Recoveries (%)								
d4 1,4-Dichlorobenzene	51	29			57			
d8 Naphthalene	65	35			69			
d10 Acenaphthene	67	32			71			
d10 Phenanthrene	80	39			75			
d12 Chrysene	82	40			69			
d12 Perylene	72	34			62			
d14 Dibenzo[a,h]anthracene	79	38			68			

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN SEDIMENT SAMPLES

(CF#1019)			*Matrix Spike*			*SRM*	
MSL ID	1019CC*4	1019CC*4-MS	*Spike*	*Percent*	SRM 1941a	*Certified*	*Percent*
Client ID	CC1 + CC3	Matrix Spike	*Amount*	*Recovery*		*Value*	*Difference*
Matrix	SED	SED			SED	SED	SED
Analytical Replicate	1	1			1		
Wet Wt.	22.54						
Units (Dry Weight)	ng/g	ng/g	ng/g	%	ng/g	ng/g	%
Percent Dry Wt. (%)	56.4		NA	NA		NA	NA
Batch	1	1	1	1	1	1	1
					1019S-SRM		
1,4 Dichlorobenzene	2.23 U	2.34 U	NS	NA	230		
Naphthalene	45.9	65.2	20.8	93	1160	1010	115
Acenaphthylene	3.86	30.9	20.8	130 *	105		
Acenaphthene	22.7	46.1	20.8	112	56.2		
Fluorene	31.3	55.4	20.8	116	108	97.3	111
Dibenzothiophene	12.5	15.4	NS		89.6		
Phenanthrene	79.4	143	20.8	307 *	605	489	124
Anthracene	34.9	66.7	20.8	154 *	257	184	140 *
Fluoranthene	154	587	20.8	2090 *	1140	981	116
Pyrene	211	483	20.8	1308 *	975	811	120
Benzo[a]anthracene	52.9	102	20.8	238 *	537	427	126
Chrysene	79.4	226	20.8	706 *	747 [a]	380	196 *
Benzo[b]fluoranthene	80.4	205	20.8	603 *	1170 [b]	740	158 *
Benzo[k]fluoranthene	33.5	106	20.8	351 *	498	361	138 *
Benzo[e]pyrene	41.8	94.0	NS		747	553	135 *
Benzo[a]pyrene	45.3	100	20.8	266 *	693	628	110
Perylene	67.4	74.4	NS		503	452	111
Indeno[1,2,3-c,d]pyrene	25.3	75.2	20.8	240 *	677	5001	135 *
Dibenz[a,h]anthracene	6.77	34.5	20.8	134 *	169 [c]	73.9	229 *
Benzo[g,h,i]perylene	28.9	73.2	20.8	214 *	670	525	128
Surrogate Recoveries (%)							
d4 1,4-Dichlorobenzene	51	52			42		
d8 Naphthalene	65	62			55		
d10 Acenaphthene	67	65			58		
d10 Phenanthrene	80	78			65		
d12 Chrysene	82	75			58		
d12 Perylene	72	66			52		
d14 Dibenzo[a,h]anthracene	79	75			59		

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a Concentration is the sum of chrysene and triphenylene.
b Concentration is the sum of benzo[b]fluoranthene and benzo[j]fluoranthene.
c Concentration is the sum of dibenz[a,c]anthracene and dibenz[a,h]anthracene.

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN SEDIMENT SAMPLES
Replicate Analysis

(CF#1019)

MSL ID	1019CC*5	1019CC*5	Mean	RPD
Client ID	CC2	CC2		
Matrix	SED	SED		
Analytical Replicate	1	2		
Wet Wt.	20.19	21.50		
Units (Dry Weight)	ng/g	ng/g	ng/g	%
Percent Dry Wt. (%)	34.1	34.1		
Batch	1	1		
1,4 Dichlorobenzene	4.10 U	10.2	NA	NA
Naphthalene	48.5	61.8	55.1	24
Acenaphthylene	5.69	5.68	5.69	NA
Acenaphthene	10.4	11.8	11.1	NA
Fluorene	22.8	26.3	24.5	14
Dibenzothiophene	10.0	13.7	11.9	32 *
Phenanthrene	63.4	98.1	80.7	43 *
Anthracene	34.2	32.5	33.3	5
Fluoranthene	107	158	133	38 *
Pyrene	173	204	189	16
Benzo[a]anthracene	43.7	52.3	48.0	18
Chrysene	59.0	83.7	71.4	35 *
Benzo[b]fluoranthene	86.3	93.5	89.9	8
Benzo[k]fluoranthene	31.5	34.9	33.2	10
Benzo[e]pyrene	46.8	51.4	49.1	10
Benzo[a]pyrene	48.9	49.2	49	0.6
Perylene	95.2	104	99.4	8
Indeno[1,2,3-c,d]pyrene	31.6	28.6	30.1	10
Dibenz[a,h]anthracene	7.13	7.51	7.32	NA
Benzo[g,h,i]perylene	38.9	35.7	37.3	9
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	29	57		
d8 Naphthalene	35	69		
d10 Acenaphthene	32	71		
d10 Phenanthrene	39	75		
d12 Chrysene	40	69		
d12 Perylene	34	62		
d14 Dibenzo[a,h]anthracene	38	68		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

(CF#1019)

PAHs IN ELUTRIATE SAMPLES

MSL ID	1019CC*1	1019CC*2	1019CC*2	1019CC*3	1019CC*7
Client ID	CC1 + CC3	CC2	CC2	CC4	Control
Matrix	Elutriate	Elutriate	Elutriate	Elutriate	Elutriate
Analytical Replicate	1	1	2	1	1
Volume extracted (mL)	300	300	300	250	300
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Batch	1	1	1	1	1
1,4 Dichlorobenzene	33.3 U	33.3 U	33.3 U	33.3 U	33.3 U
Naphthalene	64.6 U	64.6 U	64.6 U	64.6 U	64.6 U
Acenaphthylene	27.6 U	27.6 U	27.6 U	27.6 U	27.6 U
Acenaphthene	25.7 U	25.7 U	25.7 U	25.7 U	25.7 U
Fluorene	71.3 U	71.3 U	71.3 U	71.3 U	71.3 U
Dibenzothiophene	15.1 U	15.1 U	15.1 U	15.1 U	15.1 U
Phenanthrene	15.1 U	16.7	15.1 U	15.1 U	17.8
Anthracene	41.0 U	41.0 U	41.0 U	41.0 U	41.0 U
Fluoranthene	42.3 U	42.3 U	42.3 U	42.3 U	42.3 U
Pyrene	58.2 U	58.2 U	58.2 U	58.2 U	58.2 U
Benzo[a]anthracene	73.4 U	73.4 U	73.4 U	73.4 U	73.4 U
Chrysene	20.1 U	20.1 U	20.1 U	20.1 U	20.1 U
Benzo[b]fluoranthene	26.3 U	26.3 U	26.3 U	26.3 U	26.3 U
Benzo[k]fluoranthene	26.5 U	26.5 U	26.5 U	26.5 U	26.5 U
Benzo[e]pyrene	7.10 U	7.10 U	7.10 U	7.10 U	7.10 U
Benzo[a]pyrene	6.33 U	6.33 U	6.33 U	6.58	6.33 U
Perylene	15.6 U	15.6 U	15.6 U	15.6 U	15.6 U
Indeno[1,2,3-c,d]pyrene	32.6 U	32.6 U	32.6 U	32.6 U	32.6 U
Dibenz[a,h]anthracene	12.9 U	12.9 U	12.9 U	12.9 U	12.9 U
Benzo[g,h,i]perylene	64.9 U	64.9 U	64.9 U	64.9 U	64.9 U
Surrogate Recoveries (%)					
d4 1,4-Dichlorobenzene	51	41	53	24	43
d8 Naphthalene	77	63	77	36	66
d10 Acenaphthene	85	75	78	41	68
d10 Phenanthrene	95	86	87	48	77
d12 Chrysene	94	90	88	54	79
d12 Perylene	84	81	78	49	72
d14 Dibenzo[a,h]anthracene	91	87	85	53	79

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN ELUTRIATE SAMPLES

_(CF#1019)_	_Blank_	_Blank Spike A_			_Blank Spike B_			
MSL ID	1019-BLK	1019-BSA	_Spike Amount_	_Percent Recovery_	1019-BSB	_Spike Amount_	_Percent Recovery_	RPD
Client ID	Blank	Blank Spike A			Blank Spike B			
Matrix	Elutriate	Elutriate			Elutriate			
Analytical Replicate	1	1			1			
Volume extracted (mL)	300	300			300			
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%	%
Batch	1	1			1			
1,4 Dichlorobenzene	33.3 U	33.3 U	NS	NA	33.3 U	NS	NA	NA
Naphthalene	64.6 U	183	167	110	178	167	107	1.71
Acenaphthylene	27.6 U	165	167	99	177	167	106	4.88
Acenaphthene	25.7 U	173	167	104	180	167	108	2.76
Fluorene	71.3 U	180	167	108	173	167	104	2.62
Dibenzothiophene	15.1 U	15.1 U	NS	NA	15.1 U	NS	NA	NA
Phenanthrene	15.1 U	175	167	105	175	167	105	0.02
Anthracene	41.0 U	161	167	97	163	167	98	0.78
Fluoranthene	42.3 U	174	167	105	169	167	102	2.01
Pyrene	58.2 U	170	167	102	161	167	97	3.85
Benzo[a]anthracene	73.4 U	171	167	103	174	167	104	1.11
Chrysene	20.1 U	181	167	108	176	167	105	1.92
Benzo[b]fluoranthene	26.3 U	207	167	124	201	167	121	2.07
Benzo[k]fluoranthene	26.5 U	202	167	121	202	167	121	0.06
Benzo[e]pyrene	7.10 U	7.10 U	NS	NA	7.10 U	NS	NA	NA
Benzo[a]pyrene	6.33 U	181	167	108	181	167	108	0.04
Perylene	15.6 U	15.6 U	NS	NA	15.6 U	NS	NA	NA
Indeno[1,2,3-c,d]pyrene	32.6 U	195	167	117	188	167	113	2.48
Dibenz[a,h]anthracene	12.9 U	183	167	110	186	167	111	1.10
Benzo[g,h,i]perylene	64.9 U	193	167	116	188	167	113	1.68
Surrogate Recoveries (%)								
d4 1,4-Dichlorobenzene	34	55			60			
d8 Naphthalene	56	87			99			
d10 Acenaphthene	63	94			102			
d10 Phenanthrene	70	106			111			
d12 Chrysene	87	113			130			
d12 Perylene	79	101			115			
d14 Dibenzo[a,h]anthracene	90	115			131			

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NS = Not spiked.
NA = Not applicable.

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN ELUTRIATE SAMPLES

(CF#1019)	*Matrix Spike*			*Replicate Analysis*			
MSL ID	1019-MSA	*Spike*	*Percent*	1019CC*2	1019CC*2	Mean	RPD
Client ID	Spike A	*Amount*	*Recovery*	CC2	CC2		
Matrix	Elutriate			Elutriate	Elutriate		
Analytical Replicate	1			1	2		
Volume extracted (mL)	300			300	300		
Units	ng/L	ng/L	%	ng/L	ng/L	ng/L	%
Batch	1			1	1		
1,4 Dichlorobenzene	33.3 U	NS	NA	33.3 U	33.3 U	NA	NA
Naphthalene	186	167	112	64.6 U	64.6 U	NA	NA
Acenaphthylene	180	167	108	27.6 U	27.6 U	NA	NA
Acenaphthene	184	167	110	25.7 U	25.7 U	NA	NA
Fluorene	178	167	106	71.3 U	71.3 U	NA	NA
Dibenzothiophene	15.1 U	NS	NA	15.1 U	15.1 U	NA	NA
Phenanthrene	186	167	112	16.7	15.1 U	NA	NA
Anthracene	169	167	101	41.0 U	41.0 U	NA	NA
Fluoranthene	195	167	117	42.3 U	42.3 U	NA	NA
Pyrene	202	167	121	58.2 U	58.2 U	NA	NA
Benzo[a]anthracene	187	167	112	73.4 U	73.4 U	NA	NA
Chrysene	192	167	115	20.1 U	20.1 U	NA	NA
Benzo[b]fluoranthene	204	167	122	26.3 U	26.3 U	NA	NA
Benzo[k]fluoranthene	198	167	119	26.5 U	26.5 U	NA	NA
Benzo[e]pyrene	7.10 U	NS	NA	7.10 U	7.10 U	NA	NA
Benzo[a]pyrene	192	167	115	6.33 U	6.33 U	NA	NA
Perylene	15.6 U	NS	NA	15.6 U	15.6 U	NA	NA
Indeno[1,2,3-c,d]pyrene	191	167	114	32.6 U	32.6 U	NA	NA
Dibenz[a,h]anthracene	187	167	112	12.9 U	12.9 U	NA	NA
Benzo[g,h,i]perylene	195	167	117	64.9 U	64.9 U	NA	NA
Surrogate Recoveries (%)							
d4 1,4-Dichlorobenzene	59			41	53		
d8 Naphthalene	75			63	77		
d10 Acenaphthene	79			75	78		
d10 Phenanthrene	83			86	87		
d12 Chrysene	88			90	88		
d12 Perylene	80			81	78		
d14 Dibenzo[a,h]anthracene	88			87	85		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

BUTYLTINS IN SEDIMENT SAMPLES

(CF#1019)				
MSL ID	1019CC*4	1019CC*4	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	2	1	1
Wet Wt.	20.13	20.29	20.39	20.31
Units	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	54.7	54.7	50.1	43.6
Batch	1	1	1	1
Tributyltin	3.62	4.62	14.2	3.77
Dibutyltin	0.86	1.74	4.28	2.15
Monobutyltin	1.82 U	1.82 U	2.19	1.82 U
Surrogate Recoveries (%)				
Tripentyltin (SIS)	90	88	95	102

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NS = Not spiked.
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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			*SRM*		
MSL ID	10192-BLK	10192-SPK-BLKA	*Spike*	*Percent*	10192-SPK-BLKB	*Spike*	*Percent*	1019-PACS	*Certified*	*Percent*
Client ID	Blank	Blank Spike A	*Amount*	*Recovery*	Blank Spike B	*Amount*	*Recovery*		*Value*	*Difference*
Matrix	SED	SED			SED			SED	SED	SED
Analytical Replicate	2	2			2			2		
Dry Wt. (g)	NA	NA			NA			0.49		
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	ng/g	ng/g	%
Batch	1	1	1	1	1	1	1	1	1	1
Tributyltin	0.482 U	50.1	51.2	98	52.9	51.2	103	734	1271	58
Dibutyltin	0.559 U	50.1	51.4	98	49.7	51.4	97	669	1165	57
Monobutyltin	1.82 U	17.8	44.3	40	17.2	44.3	39	226	280	81
Surrogate Recoveries (%)										
Tripentyltin (SIS)	86	98			91			94		

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NS = Not spiked.

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN SEDIMENT SAMPLES

(CF#1019)		*Matrix Spike*			*Replicate Analysis*			
MSL ID	1019CC*5	1019CC*5-SPK	*Amount*	*Percent*	1019CC*4	1019CC*4	Mean	RPD
Client ID	CC2	CC2-SPK	*Spiked*	*Recovery*	CC1 + CC3	CC1 + CC3		
Matrix	SED	SED			SED	SED		
Analytical Replicate	2				1	2		
Wet Wt. (g)	20.40	20.02			20.13	20.29		
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	ng/g	%
Percent Dry Wt. (%)	50.1	50.1			54.7	54.7		
Batch	3	3			1	1		
Tributyltin	15.3	63.3	49.22	97	3.62	4.62	4.12	24
Dibutyltin	6.48	28.0	48.92	44	0.86	1.74	1.30	68
Monobutyltin	2.68	8.02	47.95	11	1.82 U	1.82 U	NA	NA
Surrogate Recoveries (%)								
Tripentyltin (SIS)	107	98			90	88		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

BUTYLTINS IN ELUTRIATE SAMPLES

(CF#1019)

MSL ID	1019CC*1	1019CC*1	1019CC*2	1019CC*3	1019CC*7
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4	Control
Matrix	Elutriate	Elutriate	Elutriate	Elutriate	Elutriate
Analytical Replicate	1	2	1	1	1
Volume extracted (mL)	300	300	300	250	300
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Batch	1	1	1	1	1
Tributyltin	3.43	3.57	5.86	3.07 U	3.07 U
Dibutyltin	5.34	5.85	6.45	5.24	12.0 U
Monobutyltin	10.8 U	10.8 U	10.8 U	10.8 U	10.8 U
Surrogate Recoveries (%)					
Tripentyltin (SIS)	48	54	44	57	55

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN ELUTRIATE SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*		
MSL ID	1019W-BLK	1019-SPK-BLKA	*Amount Spiked*	*Percent Recovery*	1019-SPK-BLKB	*Spike Amount*	*Percent Recovery*
Client ID							
Matrix	Elutriate	Elutriate			Elutriate		
Analytical Replicate	1	1			2		
Volume extracted (mL)	300	300			300		
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%
Batch	1	1	1	1	1	1	1
Tributyltin	93.4	368	425	65	411	425	75
Dibutyltin	12.0 U	372	428	87	348	428	81
Monobutyltin	10.8 U	190	369	52	167	369	45
Surrogate Recoveries (%)							
Tripentyltin (SIS)	50	18			33		

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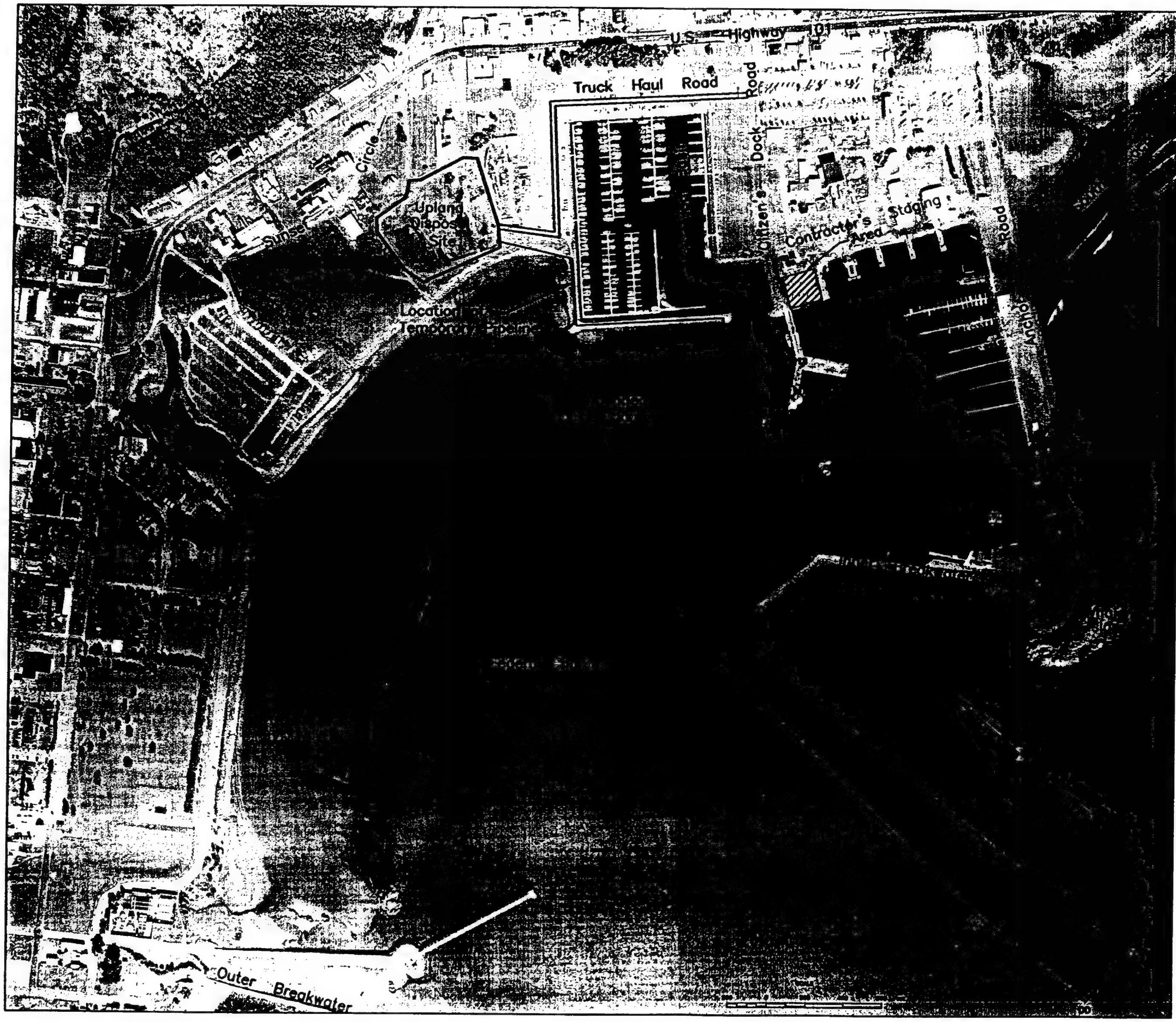
CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN ELUTRIATE SAMPLES

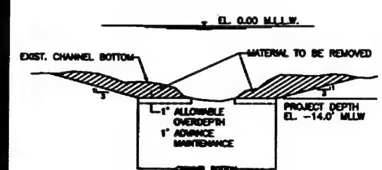
		Matrix Spike			*Replicate Analysis*			
MSL ID	1019CC*2	1019CC*2-SPK	*Amount*	*Percent*	1019CC*1	1019CC*1	Mean	RPD
Client ID	CC2	CC2-SPK	*Spiked*	*Recovery*	CC1+CC3	CC1+CC3		
Matrix	Elutriate	Elutriate			Elutriate	Elutriate		
Analytical Replicate	1	1			1	2		
Volume extracted (mL)	300	300			300	300		
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	ng/L	%
Batch	1	1			1	1		
Tributyltin	5.86	396	425	92	3.43	3.57	3.50	4
Dibutyltin	6.45	362	428	83	5.34	5.85	5.60	9
Monobutyltin	3.07 U	110	369	30	3.07 U	3.70 U	NA	NA
Surrogate Recoveries (%)								
Tripentyltin (SIS)	44	42			48	54		

U = Not detected at or above MDL.



RECOMMENDED CHANNEL POINTS		
POINT	NORTH	EAST
1	886,007.92	1,403,284.28
2	886,049.00	1,403,540.21
3	886,303.10	1,403,984.37
4	886,434.00	1,404,110.31
5	886,669.85	1,404,210.44
6	886,711.00	1,404,177.00
7	886,828.00	1,404,300.00
8	886,723.00	1,404,385.00
9	886,429.38	1,404,260.61
10	886,258.40	1,404,188.17
11	886,135.40	1,403,973.17
12	886,092.00	1,403,998.00
13	886,215.00	1,404,213.00
14	886,341.00	1,404,302.00

FEDERAL CHANNEL POINTS		
POINT	NORTH	EAST
A	885,320.00	1,404,100.00
B	885,907.50	1,403,719.25
C	886,037.97	1,403,154.12
D	885,940.16	1,402,934.90
E	885,623.01	1,402,744.40
F	885,173.16	1,402,755.60
G	885,173.16	1,402,955.60
H	885,569.54	1,402,945.78
I	885,783.11	1,403,073.85
J	885,828.05	1,403,174.33
K	885,762.63	1,403,455.34
L	885,467.45	1,403,647.06
M	885,156.92	1,403,848.20
N	885,181.10	1,403,890.17
O	885,491.63	1,403,689.03
AA	883,637.04	1,402,660.10
BB	883,645.00	1,402980.00
CC	882,945.22	1,402,997.42
DD	882,937.25	1,402,677.52



TYPICAL ACCESS CHANNEL
DREDGING SECTION
N.T.S.

U.S. Army Corps of Engineers
San Francisco District

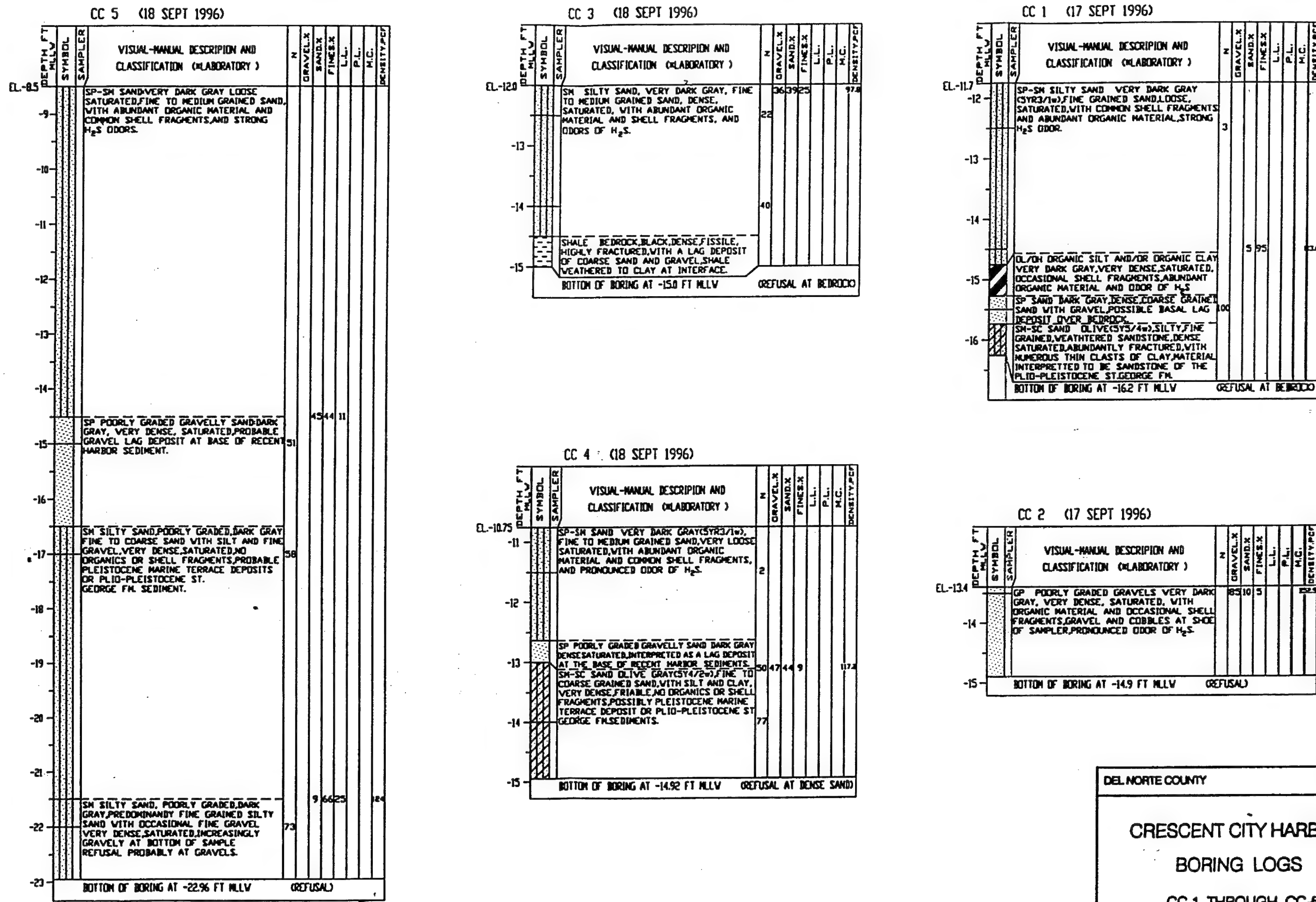
DRAWN BY: S. D.

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HABOR GRR
LOCATION OF
PROPOSED ACCESS CHANNEL
AND UPLAND DISPOSAL SITE

PREPARED UNDER THE DIRECTION OF
RICHARD G. THOMPSON
LT. COLONEL, C.E., DISTRICT ENGINEER

PLATE 1

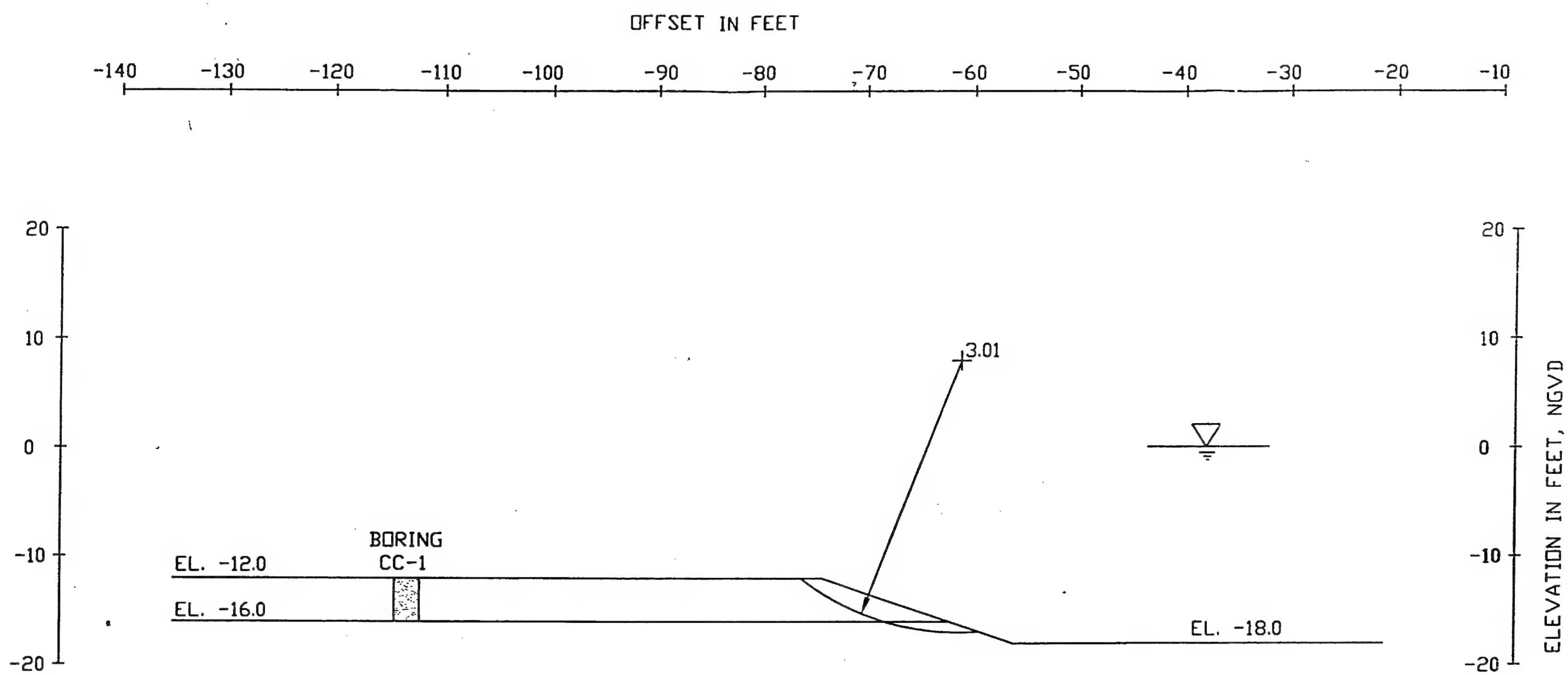


DEL NORTE COUNTY | CALIFORNIA

CRESCENT CITY HARBOR
BORING LOGS
CC-1 THROUGH CC-5

U.S ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

PLATE 2



SOIL PROPERTIES			
LAYER NO.	r(PCF)	C(PSF)	φ (DEG)
①	83	0	25
②	124	0	38

PROB NO.	SLIP SURFACE				SAFETY FACTOR
	X1 Y1	X2 Y2	X3 Y3	X4 Y4	
	-61.0	RAD			3.01
	8.0	25.0			

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HARBOR

SLOPE STABILITY ANALYSIS

SECTION 1 (BORING CC-1)

IN SHEET SHEET NO: 1

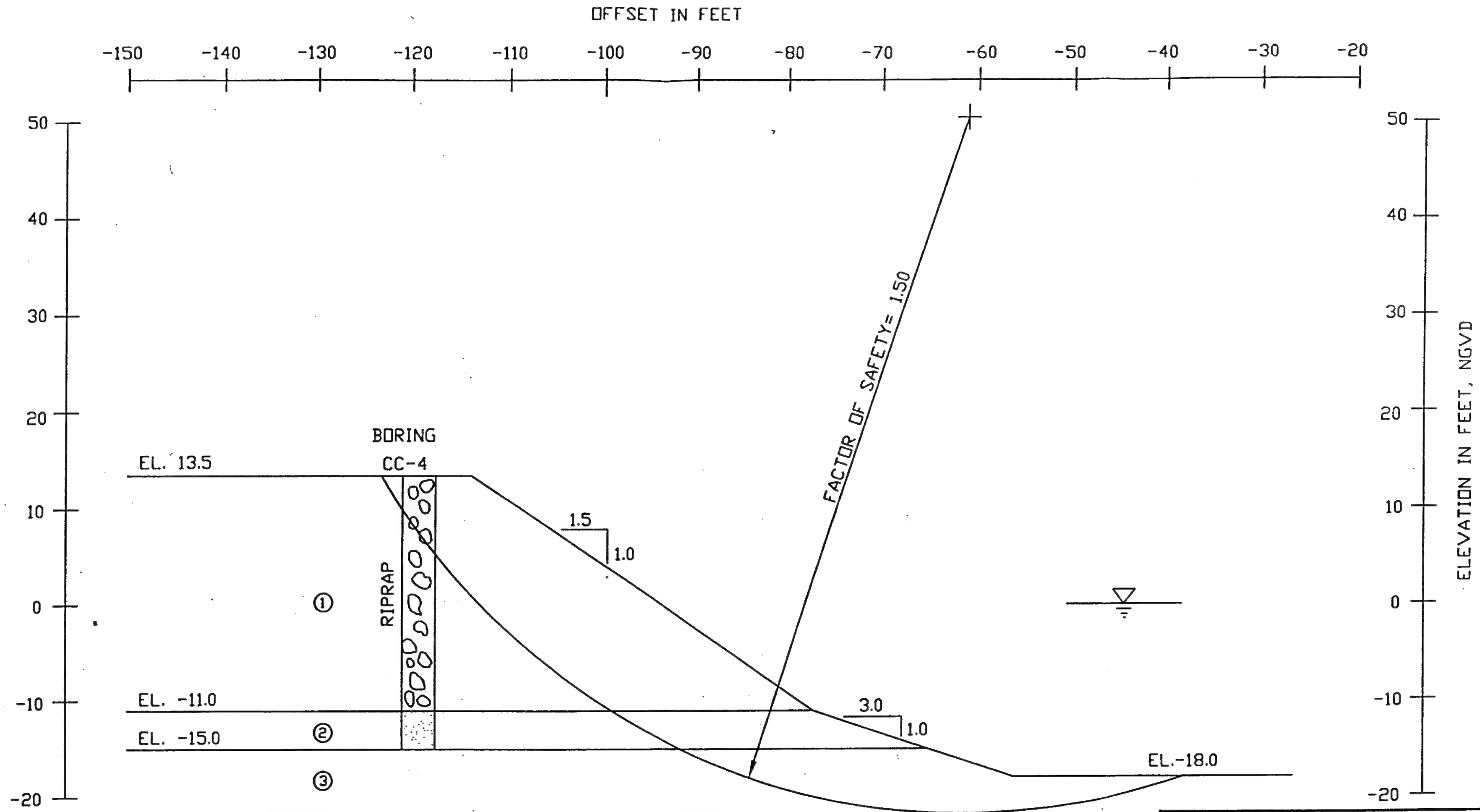
US ARMY ENGINEER DIST. SAN FRANCISCO

DRAWN:

TRACED: TO ACCOMPANY REPORT

CHECKED: DATED:

PLATE 3



SOIL PROPERTIES			
LAYER NO.	r(PCF)	C(PSF)	ϕ (DEG)
①	175	0	40
②	117	0	36
③	124	0	38

PROB NO.	SLIP SURFACE				SAFETY FACTOR
	X1 Y1	X2 Y2	X3 Y3	X4 Y4	
	-61.4 50.2	RAD 72.2			1.5

DEL NORTE COUNTY CALIFORNIA

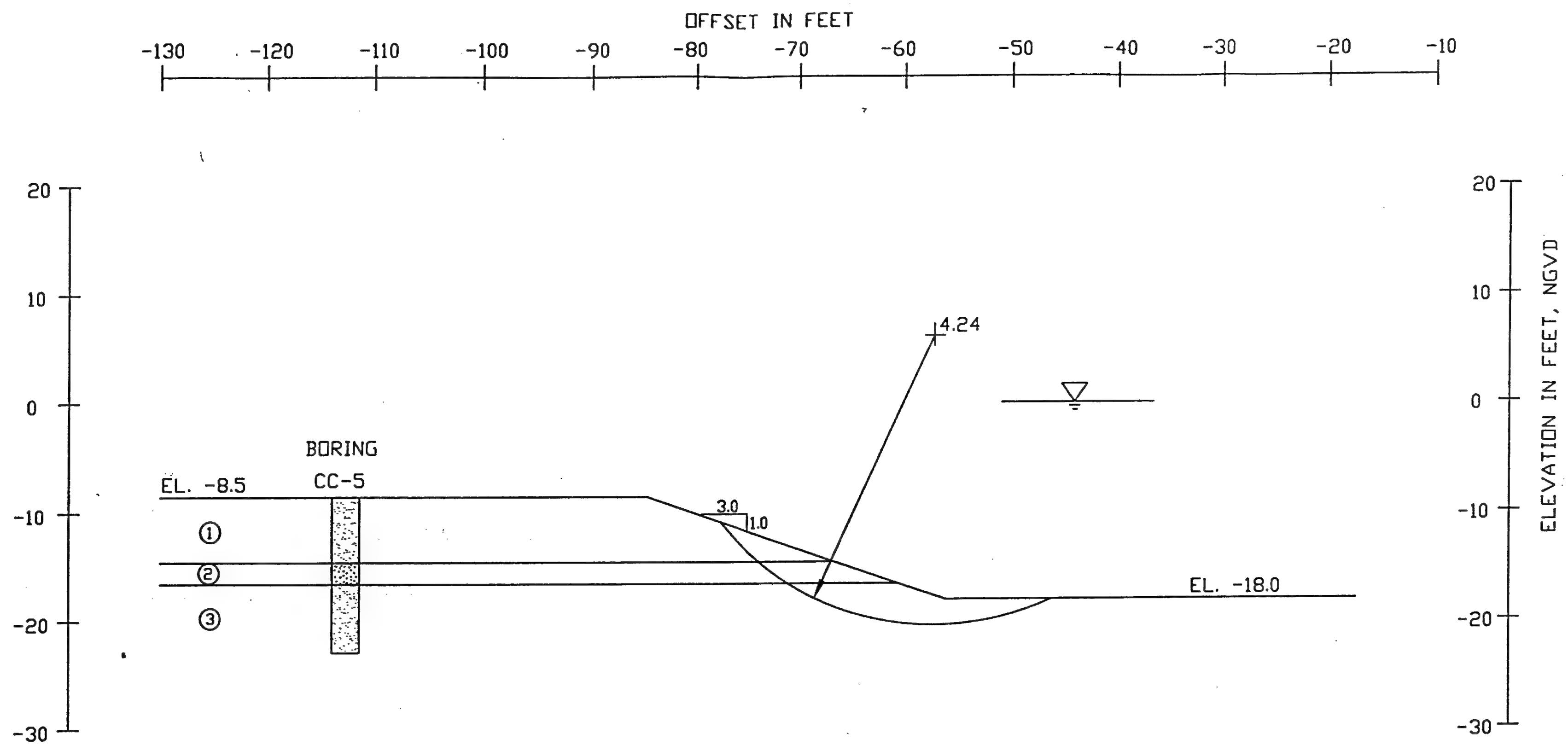
CRESCENT CITY HARBOR

SLOPE STABILITY ANALYSIS

SECTION 2 (BORING CC-4)

IN SHEET SHEET NO: 2
US ARMY ENGINEER DIST. SAN FRANCISCO
DRAWN:
TRACED: TO ACCCOMPANY REPORT
CHECKED: DATED:

PLATE 4



SOIL PROPERTIES			
LAYER NO.	r(PCF)	C(PSF)	φ (DEG)
①	83	0	25
②	124	0	38
③	124	0	38

PROB NO.	SLIP SURFACE X1 Y1	X2 Y2	X3 Y3	X4 Y4	SAFETY FACTOR
	-57.3 6.1	RAD 26.6			4.24

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HARBOR

SLOPE STABILITY ANALYSIS

SECTION 3 (BORING CC-5)

IN SHEET SHEET NO: 3
US ARMY ENGINEER DIST. SAN FRANCISCO
DRAWN:
TRACED: TO ACCCOMPANY REPORT
CHECKED: DATED:

PLATE 5

NOTES:

CONTROL SURVEY BY BESTOR ENGINEERS, MONTEREY, CA.
GRID COORDINATES ARE CALIFORNIA STATE PLANE, ZONE 1, NAD27.
ELEVATIONS ARE REFERENCED TO MEAN LOWER LOW WATER (MLLW), NGVD 1929
PHOTOGRAMMETRY BY HAMMON, JENSEN, WALLEN & ASSOCIATES, OAKLAND, CA

PHOTO CONTROL			
ID	NORTHING	EASTING	ELEV.
4100	888733.503	1402786.447	[illegible]
4101	888124.914	1402500.372	[illegible]
4102	888535.673	1403338.470	[illegible]
4103	888366.506	1404075.854	[illegible]
4104	887652.728	1403690.573	[illegible]
4105	888032.748	1402827.193	[illegible]

LEGEND

● - Borings by Geotechnical Consultants, Inc. November 1998

SCALE 50 0 50 100 150 Feet

PLATE 1 - SITE PLAN
SF98012 DECEMBER 1998

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY
TRACED BY
CHECKED BY
SUBMITTED

DEL NORTE COUNTY , CALIFORNIA
CRESCENT CITY DISPOSAL SITE

APPROVAL RECOMMENDED
APPROVED
PREPARED UNDER THE DIRECTION OF
COLONEL, C.E., DISTRICT ENGINEER
DRAWING NUMBER
01 of 01

PLATE 6

CC-6 (24 NOV. 1998)

EL.17

Depth FT MLLV	Visual-Manual Description and Classification (*Laboratory)	N	Gravel %	Sand %	Fines %	L.L.	P.L.	M.C.	Density PCF
17	SILTY FINE SAND(SM) brown, moist, medium dense, very fine to fine grained sand.	19	0	73	27				
		14							
	POORLY GRADED SAND WITH SILT(SP) gray, moist, medium dense, very fine to fine grained sand.								
10	▽	22	0	94	6			24	
	Wet, dense.	32							
5	POORLY GRADED SAND(SP) gray, wet, very dense, fine grained sand.	51	0	95	5			25	
	Color change to yellowish-brown.								
		24							
		37	1	72	27				
-3	SILTY SAND (SM) gray, wet, medium dense, very fine to fine grained sand.								
		24							
	Dense.	39							

BOTTOM OF BORING AT -9.5 FT MLLV

CC-7 (25 NOV. 1998)

EL.17

Depth FT MLLV	Visual-Manual Description and Classification (*Laboratory)	N	Gravel %	Sand %	Fines %	L.L.	P.L.	M.C.	Density PCF
17	SILTY SAND(SM) light gray, moist, loose, fine grained sand.	4							
	Trace of organics and clay.	5							
	▽								
10	POORLY GRADED SAND WITH SILT(SP) gray, wet, medium dense, fine grained sand.	25	0	93	7			27	
		55							
	Very dense.								
	Small pieces of shell, dense.	38							
0	SANDY LEAN CLAY(CL) yellowish brown, wet, very stiff with fine to medium grained sand, low plasticity.	21							
-4	SILTY SAND(SM) yellowish-brown, wet, medium dense, fine to medium grained sand.	30	0	86	14			26	
	Fine grained sand.	28							
-11	POORLY GRAINED SAND(SP) yellowish-brown wet, medium dense, fine to coarse sand with minor fine gravel.	27	0	99	1				

BOTTOM OF BORING AT -13.5 FT MLLV

CC-8 (24 NOV. 1998)

EL.15

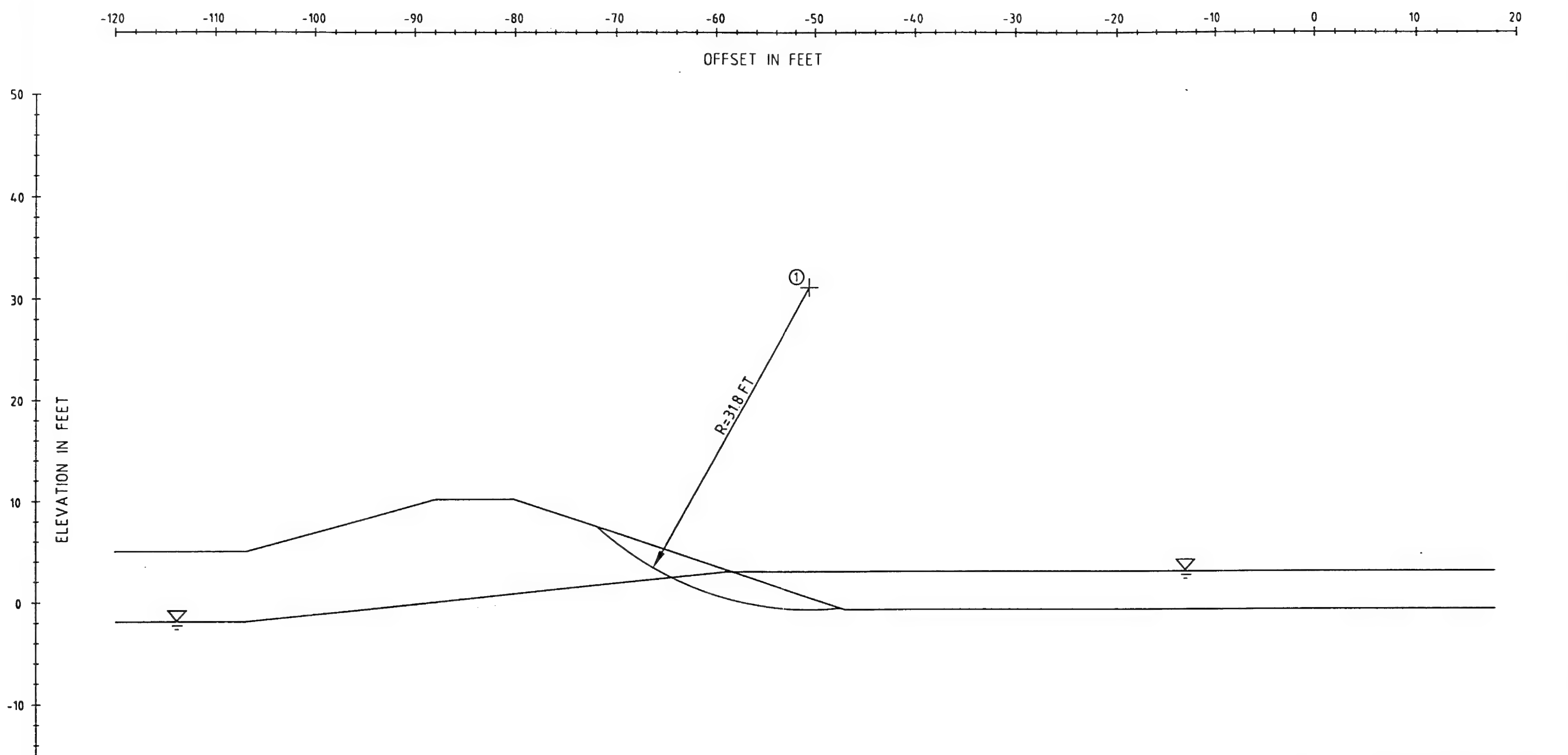
Depth FT MLLV	Visual-Manual Description and Classification (*Laboratory)	N	Gravel %	Sand %	Fines %	L.L.	P.L.	M.C.	Density PCF
15	POORLY GRADED SAND WITH SILT(SP) brown, moist, medium dense, fine grained sand.	16							
		9	0	89	11				
9	POORLY GRADED SAND WITH SILT(SP-SM) gray, moist, loose, very fine to fine grained sand. ▽								
		30	0	89	11			13	
	Wet, medium dense.								
		10							
	SILTY LEAN CLAY(CL) yellowish-brown, wet, stiff, low plasticity, lenses of silt.								
-1	CLAYEY SAND(SC) yellowish-brown, wet, medium dense, fine to medium grained sand.	17	0	[illegible]	[illegible]			25	
-4	POORLY GRADED SAND WITH SILT(SP-SM) light gray, wet medium dense, fine to medium grained sand, with iron oxide.	27	0	[illegible]	[illegible]			25	
		30							
	Dense.								

BOTTOM OF BORING AT -10.0 FT MLLV

DEL NORTE COUNTY	CALIFORNIA
DRAWN BY: P H	CRESCENT CITY HARBOR
CHECKED BY: S C	BORING LOGS
APPROVED:	CC-6 THROUGH CC-8
SCALE:	
SHEET:	

U.S ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

PLATE 7



SOIL PROPERTIES			
LAYER NO.	γ_m (PCF)	C (PSF)	ϕ (DEG)
	110	0	35°

PROB NO.	SLIP SURFACE				SAFETY FACTOR
	X1 Y1	X2 Y2	X3 Y3	X4 Y4	
①	-50.4	31.2		R=31.8	1.96

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HARBOR

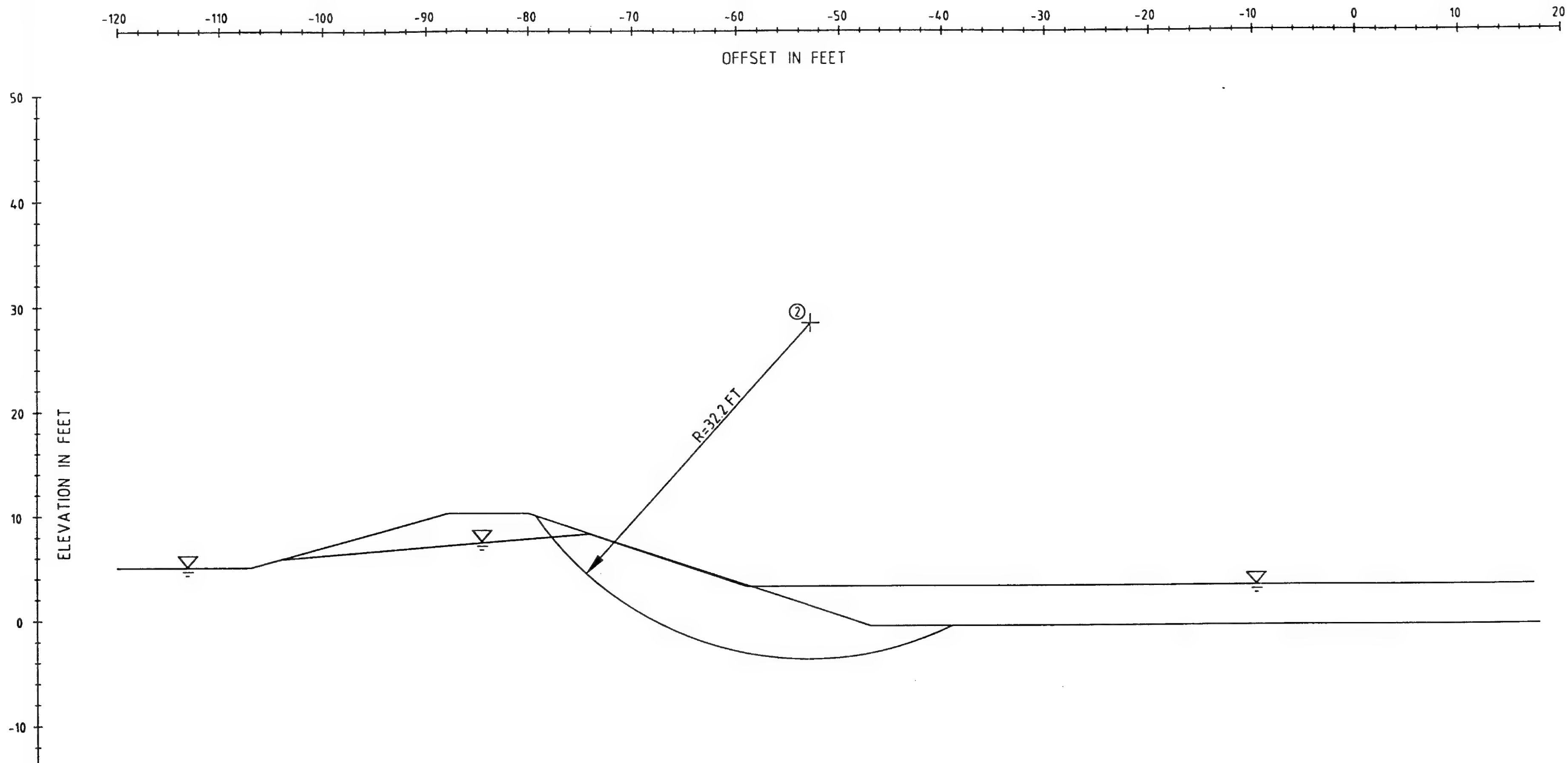
DISPOSAL SITE

LEVEE STABILITY ANALYSIS

LOW WATER LEVEL CASE

IN SHEET SHEET NO: 1
US ARMY ENGINEER DIST. SAN FRANCISCO
DRAWN: S. C.
TRACED: P. H. TO ACCOMPANY REPORT
CHECKED: DATED: SCALE: 1" = 10'

PLATE 8



SOIL PROPERTIES			
LAYER NO.	γ_m (PCF)	C (PSF)	ϕ (DEG)
	110	0	35°

PROB NO.	SLIP SURFACE				SAFETY FACTOR
	X1 Y1	X2 Y2	X3 Y3	X4 Y4	
②	-52.4	28.2		R=32.2	1.49

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HARBOR

DISPOSAL SITE

LEVEE STABILITY ANALYSIS

RAPID DOWN DRAW CASE

IN SHEET SHEET NO: 2

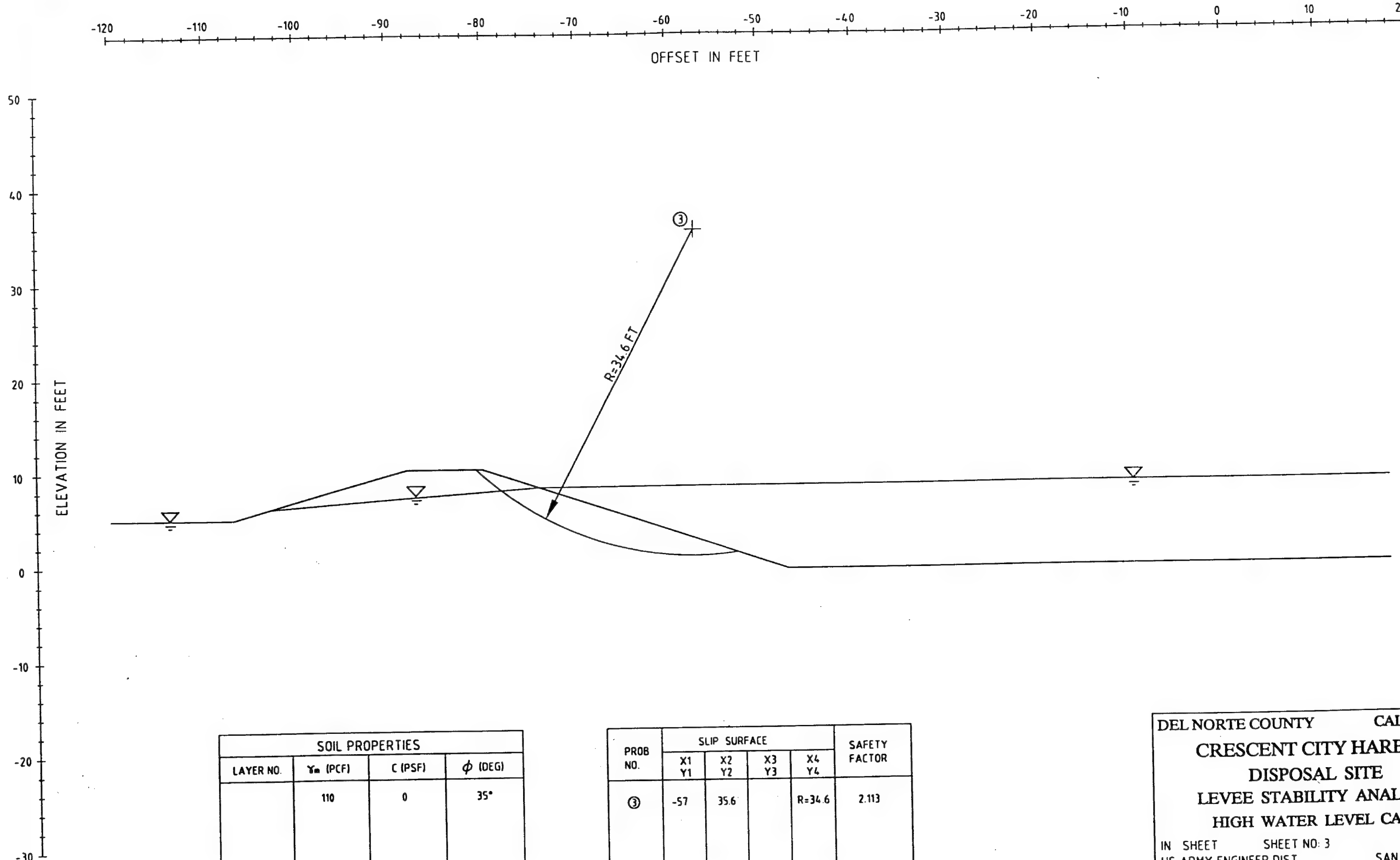
US ARMY ENGINEER DIST. SAN FRANCISCO

DRAWN: S. C.

TRACED: P. H. TO ACCCOMPANY REPORT

CHECKED: DATED SCALE : 1" = 10'

PLATE 9



SOIL PROPERTIES			
LAYER NO.	γ_m (PCF)	C (PSF)	ϕ (DEG)
	110	0	35°

PROB NO.	SLIP SURFACE				SAFETY FACTOR
	X1 Y1	X2 Y2	X3 Y3	X4 Y4	
3	-57	35.6		R=34.6	2.113

DEL NORTE COUNTY CALIFORNIA

CRESCENT CITY HARBOR

DISPOSAL SITE

LEVEE STABILITY ANALYSIS

HIGH WATER LEVEL CASE

IN SHEET SHEET NO: 3

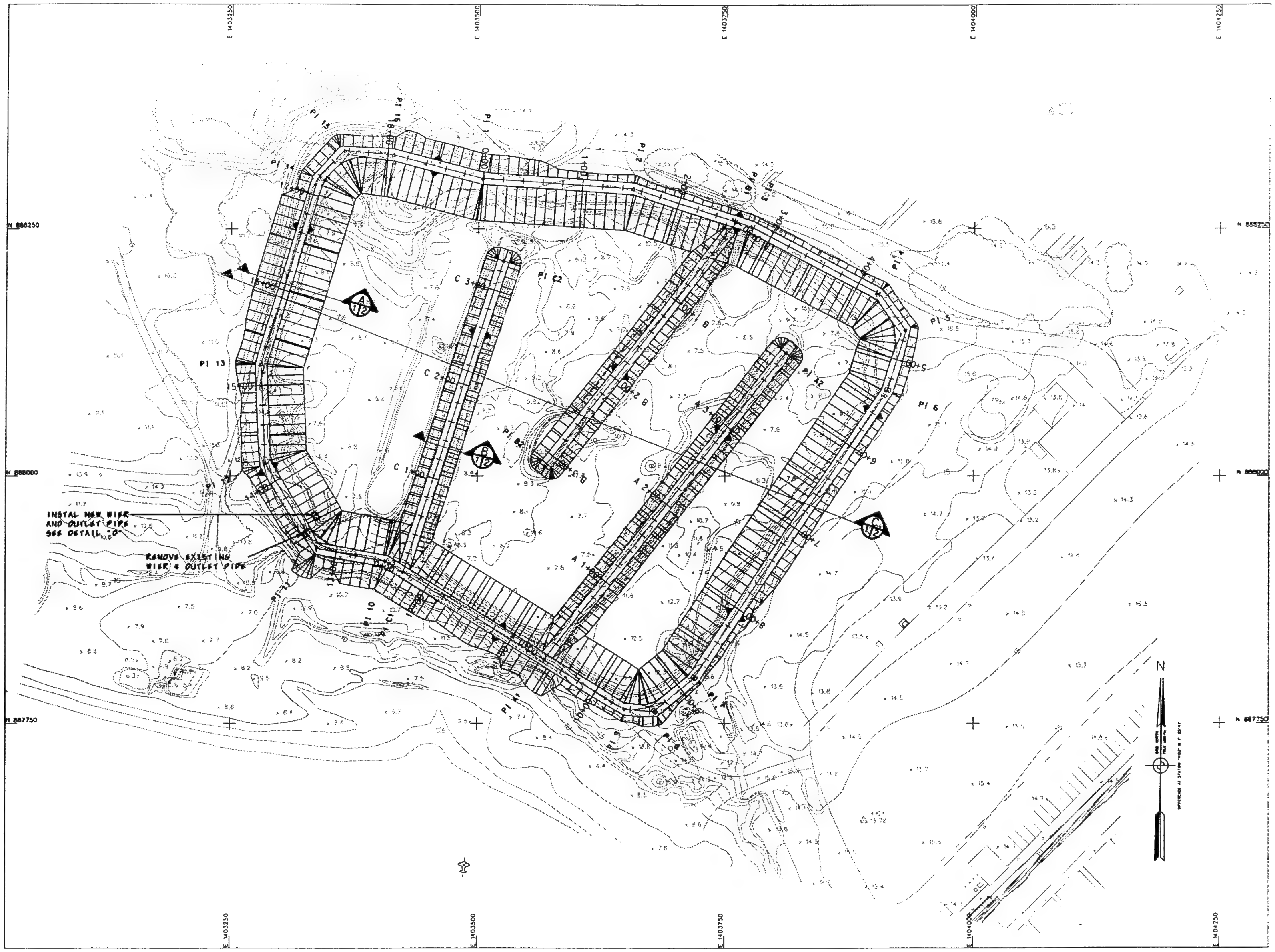
US ARMY ENGINEER DIST. SAN FRANCISCO

DRAWN: S. C.

TRACED: P. H. TO ACCCOMPANY REPORT

CHECKED: DATED: SCALE : 1" = 10'

PLATE 10



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-PLATE 11

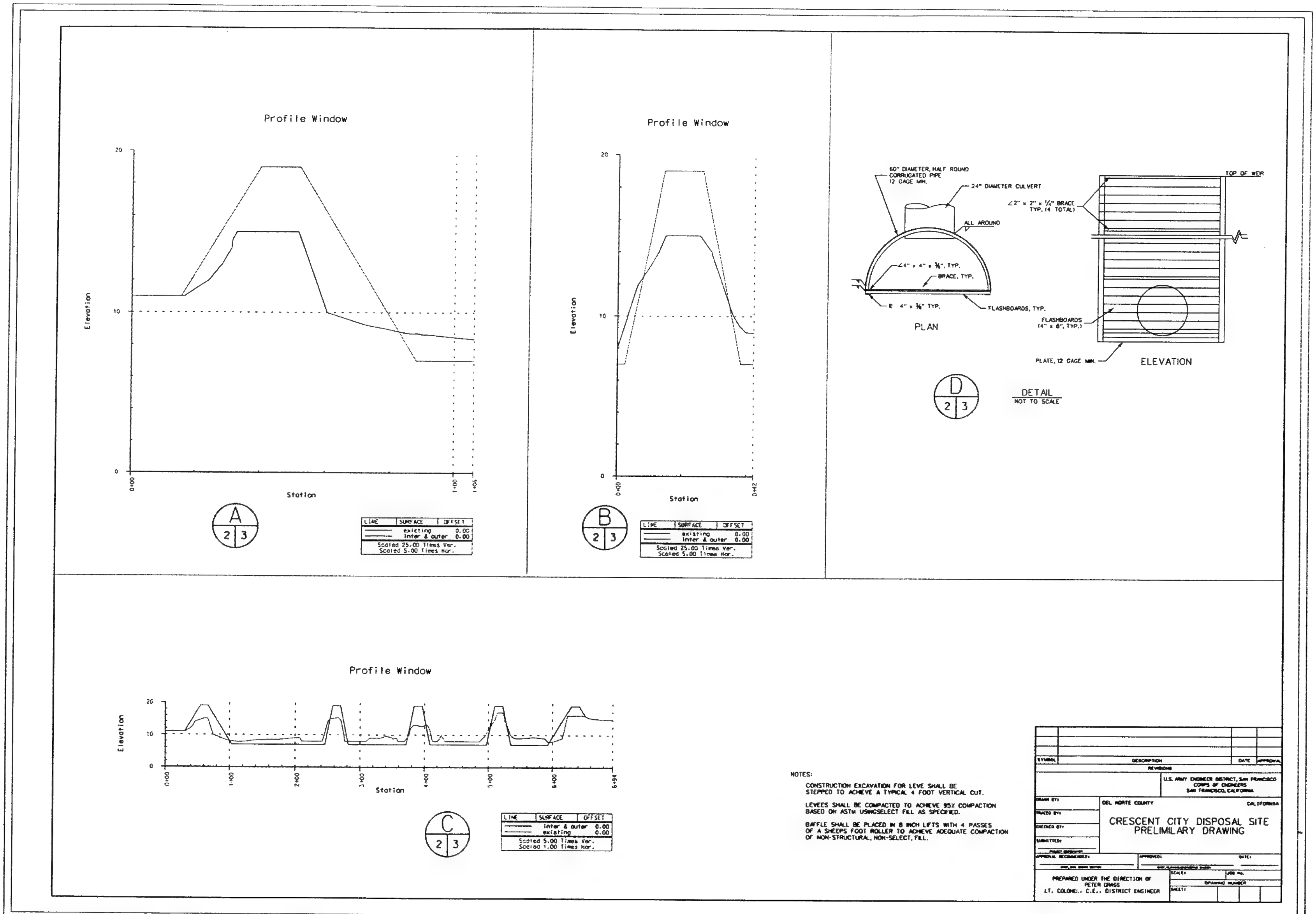

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PLATE 12

APPENDIX B

ECONOMIC ANALYSIS
& FINANCIAL ASSESSMENT

ECONOMIC ANALYSIS
GENERAL REEVALUATION REPORT
CRESCENT CITY HARBOR, DEL NORTE COUNTY, CALIFORNIA
MAY 1999

GENERAL

The Board of Commissioners of the Crescent City Harbor District requested that the Corps conduct a study to determine Federal interest in extending the existing Federal channel to the small boat basin. This portion of the analysis pertains to the economic feasibility of extending the existing channel and has been prepared in response to the Harbor District's request under the authority of Section 107 of the 1960 River and Harbor Act, as amended.

PURPOSE AND SCOPE

Since an authority to dredge the access channel area already exists, a general revaluation report (GRR) would be conducted instead of a feasibility study. This economic assessment is to determine a Federal interest in providing navigation improvements in the Crescent City Inner Harbor Basin area to the small boat basin. The assessment examines the economic feasibility of extending the existing federally maintained channel to the small boat basin.

STUDY AREA

Crescent City Harbor is a small commercial harbor on the California coast, approximately 280 miles north of San Francisco and 17 miles south of the Oregon border. The harbor, which faces south, is protected on the west by a 4700-foot long rubblemound outer breakwater and on the east by a 2400-foot long sand barrier and a 1600-foot long inner breakwater.

As seen in Figure 1, the harbor contains two berthing facilities, the commercial inner boat basin and the recreational moorage facility. The inner boat basin contains 242 permanent commercial berths with up to an additional 20 spaces available on the repair dock. The recreational moorage facility has 527 slips. The harbor also contains two fish processing plants and docks, a marine repair facility and synchrolift, a Coast Guard dock, and other auxiliary commercial and recreational facilities.

Traffic consists primarily of commercial and sport fishing vessels. Currently, commercial fishing activities make up approximately 90 percent of the total harbor commerce and are expected to continue in the foreseeable future. The latest available data indicates that 21.8 million pounds of fish and shellfish valued at $11,500,000 were landed at Crescent City in 1995.

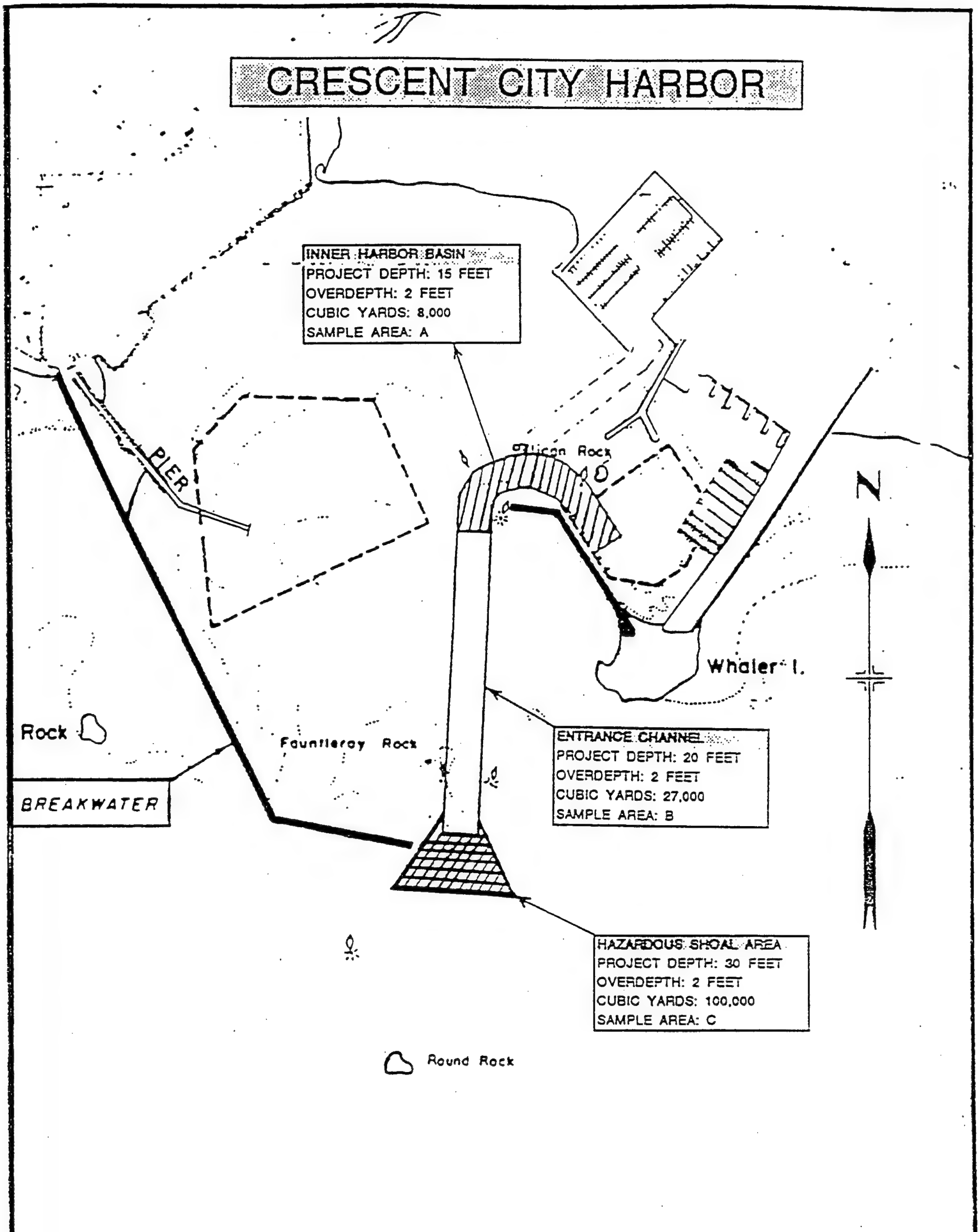

CRESCENT CITY HARBOR
INNER HARBOR BASIN
PROJECT DEPTH: 15 FEET
OVERDEPTH: 2 FEET
CUBIC YARDS: 8,000
SAMPLE AREA: A
PIER
Whaler I.
Rock
Fauntleroy Rock
ENTRANCE CHANNEL
PROJECT DEPTH: 20 FEET
OVERDEPTH: 2 FEET
CUBIC YARDS: 27,000
SAMPLE AREA: B
BREAKWATER
HAZARDOUS SHOAL AREA
PROJECT DEPTH: 30 FEET
OVERDEPTH: 2 FEET
CUBIC YARDS: 100,000
SAMPLE AREA: C
Round Rock
N

FIGURE 1

Table 1 presents the distribution of vessel slips with their respective occupancy rates. It is important to note that the occupancy rates are for both transient and permanent vessels. As seen in Table 1, the berths in the boat basin range from 30 to 70 feet in length. All of the 70-foot berths that accommodate vessels in the 61-foot to 80-foot class are currently leased, and according to harbor operators, there is a waiting list for new renters. The berths may be leased for one year.

Table 1
Inner Boat Basin Occupancy Rates for the Twelve Months
(10/93 through 9/94)

Berth Length[1]	Dock Letter	# of Berths	Average # Renters per Month	Occupancy Rate
70	A	15	15	100.0%
60	B	34	32	94.1%
50	C	46	41	89.1%
40	D	26	26	100.0%
40	E	25	24	96.0%
30	F	48	36	75.0%
30	G	48	35	72.9%
Total		242	209	86.4%

1 Vessels up to 10 feet longer than the berth length may be moored in any given slip size.
2 Dock H is the work dock and only berths boats temporarily. It does not have a fixed number of berths. Consequently, its occupancy rate cannot be determined.
Source: Crescent City Harbor District

Besides the permanently based boats, the harbor accommodated approximately 560 transient vessels between October 1993 and September 1994. Depending on the availability of slips and the size of the transient vessel, the vessels are docked either in the inner boat basin or at Citizen's Dock. Citizen's Dock is a publicly owned, Y-shaped wooden dock originally constructed in 1950 and operated by the Crescent City Harbor District. It is primarily used for unloading the commercial fishermen's catch and for refueling and loading ice. Citizen's Dock is also used by boats that cannot be accommodated in the small boat basin due to vessel size, low tides, insufficient number of slips, or a combination of factors. The Crescent City Harbor,

particularly Citizen's Dock, is used by transient vessels as a harbor of refuge.

DESCRIPTION OF THE PROBLEM

Due to insufficient protection and a depth of only 10 feet, the recreational moorage facility is not used by the commercial fishing fleet. The commercial fishing boats are experiencing navigational difficulties transiting the access channel. The access channel has been shoaling at the beach and quaywall through the boat basin entrance to the north wing of Citizen's Dock and out along the access channel leading into the federally maintained channel. Over the years, the shoaling has worsened, restricting access for fishing vessels, particularly for the larger boats, which must work the tide. This restricted channel depth results in delays and vessel damages to the larger boats. The vessel delays can be broken down into two categories, delays for the larger vessels and indirect delays for the smaller vessels. Larger vessels are delayed directly when they cannot load or unload in time to catch the tide. Once they miss the tidal window, they must wait until the tide allows them to depart safely. Smaller vessels are delayed when the tide traps the larger vessels, blocking access to Citizen's Dock and preventing subsequent vessels to enter. This type of delay will effect a boat regardless of its draft.

The Harbor District maintains the boat basin to a depth of -12 feet Mean Lower Low Water (MLLW) and performs limited annual dredging in the boat basin entrance area. Restricted by its dredge plant and equipment's capability, it is difficult to maintain sufficient water depths. The Harbor District sees a need to provide a channel with a consistent depth from the boat basin to the deeper federally maintained Inner Harbor Channel. Furthermore, they are willing to deepen some slips in the small boat basin to a depth commensurate with the proposed project depth. The Harbor District is proposing to deepen the 15 berths along Dock A to 14 feet and possibly convert the work area along Dock H into berths that would be capable of accommodating vessels with drafts of 14 feet. Dock H was recently converted into a dual-purpose dock to be used to work on boats and to accommodate larger vessels.

DATA COLLECTION

- Commercial Fishery Landings and Value of Landings

During the period 1990-1995, Crescent City landed an average of 29.8 million pounds of fish and shellfish. These landings represent approximately 9 percent of the landings statewide and 10 percent of the dollar value over the same period. The primary species landed at Crescent City in 1995 were shrimp, whiting, crab, rockfish, Dover sole, thorny heads and sablefish. These species contributed approximately 85 percent of the 1995 landings. Table 2 presents the commercial fishery landings and the value of the landings for Crescent City and Statewide from 1990 to 1995.

Table 2
Commercial Fishery Landings & Value of Landings

Year	Crescent City				California	
	Quantity (millions of lbs.)	% of State Total	Value (millions)	% of State Total	Quantity (millions of lbs.)	Value (millions)
1990	31.7	7.9%	$14.9	9.4%	395.8	$158.9
1991	30.2	8.1%	$11.1	8.0%	371.5	$139.4
1992	39.2	13.1%	$16.7	12.5%	299.2	$133.5
1993	27.2	8.5%	$14.3	11.2%	318.3	$127.3
1994	28.9	8.7%	$18.4	12.4%	330.6	$148.8
1995	21.8	5.0%	$11.5	6.9%	435.0	$167.8
Mean	**29.8**	**8.6%**	**$14.5**	**9.9%**	**358.4**	**$146.0**

Source: *California Department of Fish and Game, Marine Resources Division*

- Commercial Fishing Fleet

The existing commercial fishing fleet, permanently based at the harbor, consists of 157 commercial fishing boats, averages 43 feet in length, and possesses design drafts (unloaded vessel drafts) ranging from 1 to 13 feet. Table 3 presents a distribution of permanent fleets and the transient fleet for the period October 1993 to September 1994. Over this time, an average of 46 transient vessels used the harbor each month. During the peak of the fishing season, all berths in the inner boat basin are full and there is often a waiting list.

Table 3a
Crescent City Fleet Distribution
10/93 to 3/94

Length	Permanent Vessels	Annual Transient Average	10/93	11/93	12/93	1/94	2/94	3/94
19 or less	0	0	0	0	0	0	0	0
20-29	17	1	1	6	3	2	3	1
30-39	40	5	7	12	6	12	9	8
40-49	34	6	12	14	9	19	11	7
50-59	26	7	21	23	10	15	6	5
60-69	9	2	6	8	3	5	2	0
70-79	14	1	3	1	1	0	0	1
80-89	0	0	2	2	0	1	0	0
90-99	0	1	2	2	2	1	0	0
100 or more	0	0	0	0	0	0	0	0
Total	140	22	54	68	34	55	31	22

Table 3
Crescent City Fleet Distribution
4/93 to 9/94

Length	Permanent Vessels	Annual Transient Average	4/94	5/94	6/94	7/94	8/94	9/94
19 or less	0	2	0	0	0	0	0	0
20-29	17	5	3	3	4	4	4	4
30-39	40	4	7	7	4	2	10	25
40-49	34	6	8	2	0	3	8	23
50-59	26	3	8	7	10	9	14	21
60-69	9	2	1	3	5	7	6	9
70-79	14	1	1	1	5	6	4	5
80-89	0	0	0	3	1	1	1	2
90-99	0	0	0	0	2	1	1	0
100 or more	0	0	0	0	1	0	0	1
Total	140	21	28	26	32	33	48	90

Source: Crescent City Harbor District. Permanent boat list and Transient boat log.

• Fishing Seasons, Vessel Sizes, and Number of Days Fished

Fishing Seasons

The number of boats using the harbor varies according to the fishing season. There are three distinct fishing seasons. The whiting season extends from the end of March through mid-October. The crab season begins December 1 and ends July 15th. The season is often broken into two parts, with significant quantities being harvested during the first few weeks of the season and again in June. The shrimp season runs from April until July. Salmon and tuna are also harvested from boats operating out of Crescent City, but the salmon catch is currently restricted by State law, and the harvesters usually meet their catch in the first few days of the season.

Vessel Size

Many vessels in the Crescent City fleet fish for more than one species, and consequently, more than one season. Although the fleet is generally not dedicated to one type of fish, the largest boats are used more often than the smaller ones for harvesting whiting. The whiting boats are the largest, with lengths of 80 feet and more. The boats used to harvest crab range in size from 12 to 70 feet, and the shrimp boats are generally between 50 and 70 feet. Table 4 displays the fleet distribution for Crescent City Harbor.

Table 4
Crescent City Fleet Distribution
(October 1993 to September 1994)

Length (feet)	Draft[1] (feet)	Permanent Vessels	Annual Transient Average
30-39	6	40	26
40-49	8.25	25	34
50-59	9	26	48
60-69	11	9	48
70 or more	11.5	14	4

[1] Computed as the average draft within each class of the Crescent City commercial fishing fleet.

Days Per Trip

According to the Crescent City Harbor Master, most of the boats operate approximately 200 days per year. The number of days per trip is dictated by several factors including what is being harvested, vessel size, storage capability, and weather conditions. The days per trip can

vary from one to ten. After ten days, the quality of the fish rapidly deteriorates. Another factor limiting the length of whiting trips is that the fish are attracted to light. Therefore, they can only be caught during the daylight hours. The fishermen estimated the number of days per trip for all fish species to be between three and five.

WITHOUT PROJECT CONDITION

The economic benefits from a dredging project will primarily be the reduction in tidal delays presently experienced by the commercial fishing fleet. In addition benefits for the reduction in damages to Citizens Dock and employment benefits associated with project construction will be presented in subsequent sections. This section addresses the economic costs associated with the "Without Project" condition

To get from the inner boat basin, the fishing fleet uses the access channel that leads to the harbor entrance. The access channel also services Citizen's Dock and its facilities. Citizen's Dock provides services to both inbound and outbound vessels; the outbound vessels take on fuel, ice, and other supplies while inbound vessels use the facilities to off-load their catch.

The first type of delay affects larger vessels (greater than 60 feet in length). Because of the restricted channel depths associated with shoaling, vessels must (1) wait until high tides to access the channel, (2) leave the inner boat basin early to avoid a low tide, or (3) wait at Citizen's Dock. These all lead to increased operating costs and create economic losses.

The second type of delay centers on the smaller classes of boats. These boats are also being delayed, but the delays revolve around their inability to access the facilities at Citizen's Dock. When the larger boats reach Citizen's Dock, they often ride the tide, however they are often still on-loading or off-loading when the tide goes out. Consequently, they cannot enter the access channel and free up the facilities at Citizen's Dock until the tides are high enough. When the larger boats are unable to leave Citizen's Docks due to tidal delays, the smaller boats cannot access the facilities. This delays the smaller boats even when their actual drafts are too shallow to be affected by the tidally influenced change in channel depth.

• Tidal Delay Costs

The duration and frequency of tidal delays were based on interviews with Harbor District personnel and local fishermen. Both agreed that vessels, with drafts of 11 feet or more, are frequently delayed due to the tidally induced changes in channel depth and the irregular nature of the channel floor. In fact, vessels with drafts as shallow as 9 feet are occasionally delayed as a direct result of tidal changes.

The field data indicated that vessels of 70-feet or longer experienced 5 hour delays approximately 12 times per year. Vessels in the 60-foot to 69-foot class were also delayed

approximately 12 times per year, but only for 4 hours per delay. The smaller vessels in the other size classes were delayed approximately 10 times per year for about 3 hours a delay. Again, the smaller boats are not delayed directly due to draft limitations. Their delays are the result of not being able to access the facilities at Citizen's Dock.

That the smaller boats are delayed almost as much as the larger boats is not surprising due to the concentrated nature of the fishing industry. Given the fixed fishing seasons dictated by legislation and by the short biological "windows of opportunity", it is not unusual for large portions of the fleet to leave and to return to port at approximately the same time, thereby increasing the likelihood of delays. These delays can be exacerbated by competition for reduced facility space that is a result of tidal delays.

The tidal delay costs are derived by finding the duration and frequency of tidal delays and then matching these events with specific vessel size classes and operating costs. The field data provided the source for the duration and frequency of tidal delays. The data for the vessel size classes came from the Harbor District's files. These files included information on vessel length, beam, and draft. This information was then supplemented with data collected from the field interviews. The data was then used to compile a distribution of vessel lengths and drafts.

Vessel operating costs were obtained from the PACFIN Research Database provided by the National Marine Fisheries Service--Southwest Fisheries Center. This comprehensive database contains cost information and characteristics for hundreds of Washington, Oregon, and California fishing vessels surveyed over the period 1981-1989, the most recent years available. Fixed costs include off-load expenses, rent, insurance, travel, supplies, depreciation, and other office expenses. Variable costs include fuel, provisions, crew, tax, repairs, dues, bait, and ice. Opportunity costs were also included as part of the fleets operating costs.

Opportunity costs represent a fair value of the operators' labor, management and investment. The opportunity cost of labor and management is equal to the amount that an operator could have earned as a hired skipper or manager. The representation of labor opportunity costs in this report utilizes the same methodology as was used by the Oregon State University Extension Service to determine the opportunity cost of labor. This method of acquiring the labor and management cost of the vessel operator was arrived at after consultation with the Southwest Fisheries Science Center and was felt to be the best way to derive opportunity costs given the relative lack of information available on the subject.

The Extension Service prepared the Marine Economic Data Sheets to fill a void in the acquisition of small vessel costs. One of the costs documented by the Extension service was the opportunity cost of labor and management. The Extension Service represented this cost as a percentage of a vessels gross revenue. Different fisheries generated different opportunity costs. The opportunity cost used in this report was associated with the west Coast ground fish fisheries. Not only was the West Coast Ground fish fishery the most conservative estimate of labor opportunity cost, at 18% of a vessels Gross Revenue, it was also the closest match in terms of

geographic location and fishery. The daily opportunity cost was derived by dividing the yearly opportunity cost by the average number of days fished for a given vessel size class.

The opportunity cost of capital was represented by taking the average depreciated market value for a given size class of fishing vessels and multiplying it by the federal discount rate (FY 99). This represents the amount of income that could have been generated from an alternative business investment.

These costs were converted into daily operating costs for the respective vessel sizes. Table 5 shows the overall operating costs and Tables 5a. through 5c show the derivation of labor and opportunity costs.

Table 5
Average Daily Operating Cost

Vessel Size (length in feet)	Average Daily Variable Cost	Average Daily fixed Cost	Average Daily Opportunity Cost	Total Daily Operating Cost
31-40	$ 106	$ 67	$ 98	$ 271
41-50	$ 583	$ 303	$ 299	$ 1,185
51-60	$ 661	$ 454	$ 405	$ 1,520
61-70	$ 932	$ 507	$ 414	$ 1,854
71 and Above	$ 1,190	$ 599	$ 491	$ 2,281

Table 5a
Total Opportunity Cost

Vessel Size (length in feet)	Daily Opportunity Cost of Labor	Daily Opportunity Cost of Capital	Total Daily Opportunity Cost
31-40	$ 91	$ 7	$ 98
41-50	$ 222	$ 77	$ 299
51-60	$ 321	$ 84	$ 405
61-70	$ 304	$ 110	$ 414
71 and Above	$ 402	$ 89	$ 491

Table 5b
Opportunity Cost of Capital

Vessel Size (length in feet)	Average of Depreciated Vessel Value	Opportunity Cost of Capital Factor	Yearly Opportunity Cost of capital	Daily Opportunity Cost of Capital
31-40	$ 22,289	6.875%	$ 1,532	$ 7
41-50	$ 235,906	6.875%	$ 16,219	$ 77
51-60	$ 263,615	6.875%	$ 18,124	$ 84
61-70	$ 339,705	6.875%	$ 23,355	$ 110
71 and Above	$ 471,241	6.875%	$ 32,398	$ 89

Table 5c
Opportunity Cost of Labor

Vessel Size (length in feet)	Average Gross Vessel Revenue	Opportunity Cost of Labor Factor	Yearly Opportunity Cost of Labor	Daily Opportunity Cost of Labor
31-40	$ 105,093	18%	$ 18,917	$ 91
41-50	$ 261,128	18%	$ 47,003	$ 222
51-60	$ 385,087	18%	$ 69,316	$ 321
61-70	$ 349,197	18%	$ 62,855	$ 304
71 and Above	$ 473,756	18%	$ 85,276	$ 402

Base Source Data: National Marine Fisheries Service-Southwest Fisheries Center "West Cost Fishing Fleet Cost-Earnings Data Base"

The yearly tidal delay costs for the respective vessel sizes range from $22,600 to $135,500 and are detailed in Table 6. The total yearly tidal delay costs amount to $414,900 and were calculated using the following formula:

(# of vessels in size class) x (# of days delayed x (Daily Operating Cost) = Tidal Delay Cost

Table 6
Tidal Delay Costs

Vessel Size (length in ft.)	# of Affected Boats[2]	Ave. Hourly Delay	# of Times Delayed per Year	Hours Delayed per Year[3]	# of Days per Year Delayed*	Daily Operating Cost	Average Annual Delay Cost**
30-39	49	3	10	30	1.7	$ 271	$ 22,553
40-49	44	3	10	30	1.7	$ 1,185	$ 88,623
50-59	38	3	10	30	1.7	$ 1,520	$ 98,205
60-69	14	4	12	48	2.7	$ 1,854	$ 70,080
70 +	18	5	12	60	3.3	$ 2,281	$ 135,468
Total	**163**						**$ 414,928**

[1] Drafts were chosen as being representative of Crescent City commercial fishing fleet. For additional information see appendix A Table 3

[2] Includes all permanent boats using the small boat basin, as well as transients berthing in the small boat basin or at Citizen's Dock

[3] Hours delayed per Year = [(average hourly delay*Number of times delayed per year)

* Number of days delayed = Hours delayed per year/(working hours)]. The number of hours worked per day ranges from 12 to 24 hours, hence the median of 18 hours per day was used for the analysis.

** Average annual delay cost = (days delayed) x (daily operating cost) x (number of vessels)

- Damage to Citizen's Dock

Citizen's Dock was designed to provide access to services for the fishing fleet. It was not designed as a moorage facility. According to harbor officials extensive use of Citizen's Dock by transient and permanent vessels causes stress to the pier's pilings. The dock was originally constructed in 1950 and underwent major reconstruction after the 1964 tidal wave. During the summer of 1987, the Harbor District replaced all of the outside pilings (at a cost of $100,000). An additional four pilings were replaced during the summer of 1988 at a cost of approximately $8,000. By November 1988, two more pilings were broken and needed to be replaced.

The Harbor District believes that the source of damage to citizens dock is the result of a combination of factors. These damaging factors are thought to be related to extended vessel mooring practices, exposure to wind and tides, and wakes created by passing vessels. Because there is no objective and quantifiable method to distinguish how much damage is attributable to each factor, the local expertise of Harbor District was used to quantify damages. The Harbor District believes that the primary cause of piling damage is attributable to vessel mooring practices. Project implementation would reduce both the number of vessels mooring at Citizens dock and the length of time that vessels are moored at the dock.

Because there is no established methodology to determine the exact proportion of damages attributable to vessel mooring practices, the Harbor Districts estimate was used to determine annual damages prevented. The Harbor District believes that 50 to 75 percent of the $9,300 (1995 Dollars) in average annual damages would be eliminated by project

implementation. The conservative estimate of 50 % was used to generate the benefit of $4,650. It was estimated that this benefit would be captured by all of the alternatives.

WITH PROJECT CONDITION AND BENEFITS

- Tidal Delay Reduction Benefits

For the "With Project" condition, the tidal delay reduction benefits were distributed according to the lowest daily tidal distribution (Table 7). For example, the 12-foot project depth helps eliminate 15 percent of tidal delays. This means that for a project depth of 12 feet MLLW the benefits will be $62,239 (0.15 × $414,928). Likewise the benefits for a 16-foot project depth would be $414,928. At this project depth all delays experienced by the fishing fleet are eliminated. Table 7 below presents the tidal delay reduction benefits for the various project depth alternatives.

Table 7

Tidal Frequency Distribution and Corresponding Benefit Adjustment

Tide Level (ft)	Lowest Daily Tide Distribution *	% Distribution	(MLLW)	Potential Tidal Delay Reduction	Adjusted Benefits
1.1 to 2.0	54	15%	-12 ft	15%	$62,239
0.1 to 1.0	150	42%	-13 ft	57%	$236,509
-0.9 to 0.0	107	30%	-14 ft	88%	$365,137
-1.9 to -1.0	38	11%	-15 ft	98%	$406,630
-2.0 to less	6	2%	-16 ft	100%	$414,928

* *Source: San Francisco District Hydraulics & Coastal Section*

- Reduction in Damages to Citizen's Dock

Under all of the project alternatives damages to Citizens Dock would be reduced by 50 percent.

- Employment of Previously Unemployed Resources

This benefit category recognizes the fact that project construction can create an economic benefit when previously unused or under used resources are productively employed. In areas where there is full employment, project construction (and the construction employment that goes with it), will not yield national economic development benefits. This is because previously employed resources will be pulled from their prior employment into the new employment offered by project construction Conversely, the employment of previously unemployed labor resources

does not have an opportunity cost. Consequently, ER 1105-2-100 Chapter 6 Section XI states that the employment of previously unemployed labor can constitute an NED Benefit if certain criteria are met.

These criteria require that "substantial and persistent" unemployment exists in the study area, or more specifically (1) The current rate of unemployment, as determined by appropriate annual statistics for the most recent 12 consecutive months, is 6% or more, and has averaged at least 6% for the qualifying time periods specified in (2) and (2) The annual average rate of unemployment has been at least: (i) 50% above the national average for three of the preceding four calendar years, or (ii) 75% above the national average for two of the preceding calendar years, or (iii) 100% above the national average for one of the preceding two calendar years. Crescent City Harbor, located in Del Norte County, meets the criteria for employment of previously unemployed resource benefits, as explained below.

The "local area" is defined as Del Norte County. "Substantial and persistent" unemployment was based on the criteria one and two. Table 8a presents the unemployment rates in Del Norte County for the most recent twelve months of record. Since the current unemployment rate for the most recent 12 consecutive months is above 6 percent, the first criterion has been met.

Table 8b compares the unemployment rates for Del Norte County with those of the US as a whole. As seen from the table, the annual average rate of unemployment has been at least 50 percent above the national average for three of the preceding four calendar years and 75 percent above the national average for two of the preceding calendar years. Therefore, the second criterion for employment benefit qualification has also been met.

Table 8a
Unemployment Rates for Del Norte County (September 1995 to August 1996)

Month	Percent of Unemployed
September	9.5%
October	10.1%
November	13.5%
December	9.8%
January	12.4%
February	12.5%
March	12.6%
April	11.6%
May	10.3%
June	9.6%
July	9.7%
August	8.6%

Sources: United States Bureau of Labor Statistics, Department of Commerce; State of California (EDD)

Employment Development Department

Table 8b
Crescent City Harbor Project
Unemployment Rates for Del Norte County and the United States

	1992	1993	1994	1995
Del Norte County	15.0%	13.8%	12.0%	11.9%
United States	7.4%	6.8%	6.1%	5.6%
% Above US	102.7%	102.9%	96.7%	112.5%

To define the employment benefits associated with the Crescent City channel-deepening project, the percent of project construction costs accruable to the labor component of construction was estimated to be 50 percent. Because there is no local hiring rule it was estimated that only 30 percent of the labor resources employed in project construction would be local resources.

In order to quantify the employment benefits the construction cost associated with the NED plan needed to be defined. Therefore a display of the possible alternatives, form which the NED plan will be chosen, and the costs associated with them are presented below in Table 8c. Using the estimated design cost associated with the various project alternatives, the labor benefits were calculated. The employment benefits range from $8,000 for a 13 foot channel with 1 foot of allowable over depth to $17,100 for a 15 foot channel with 1 foot of advance maintenance and 1 foot of allowable over depth. These benefits were determined using the following formula. This formula recognizes the current (FY'99) Federal Discount Rate and a project life of 50 years.

(Construction Cost) × 0.50 (Labor Component) × 0.30 (Local Labor Factor) x
0.07312 (Capital Recovery Factor For a 50 Year Project Life @ the FY 99 Discount Rate)

Table 8c

Employment Benefits by Project Alternative

Labor Factor	50%
Local Labor Factor	30%
Capital Recovery Factor	0.07132

Project Depth	Advance Maint.	Over Depth	Construction Costs *	Employment Benefits
-13		-1	$ 750,488	$ 8,029
-13	-1	-1	$ 775,090	$ 8,292
-14		-1	$ 796,053	$ 8,516
-14	-1	-1	$ 837,774	$ 8,963
-15	-1	-1	$ 1,596,882	$ 17,083

* *Source: San Francisco District, Cost Estimating Section*

BENEFIT SUMMARY

The project benefits are comprised of tidal delay reduction benefits, the reduction in damages to Citizen's Dock, and employment benefits. Table 9 presents the benefits by alternative. The incremental nature of the benefit presentation is fully explained in the optimization section. The combined benefits range from $249,200 for a 13 + 1 foot channel (allowable overdepth) to $436,700 for a 15 + 2 foot channel.

Table 9

Benefit Summary

Project Depth	Advanced Maint.	Over Depth	Tidal Delay Reduction Benefits	Reduction in Damages to Citizens Dock	Employment Benefits	Total Benefits
-13		-1	$ 236,509	$ 4,650	$ 8,029	$ 249,188
-13	-1	-1	$ 365,137	$ 4,650	$ 8,292	$ 378,079
-14		-1	$ 365,137	$ 4,650	$ 8,516	$ 378,303
-14	-1	-1	$ 406,630	$ 4,650	$ 8,963	$ 420,242
-15	-1	-1	$ 414,928	$ 4,650	$ 17,083	$ 436,662

PROJECT COSTS

The costs to the Crescent City Harbor Project were determined by the District's Cost Estimating Section and include lands and damages, dredging, planning, engineering and design, as well as construction management. Table 10 presents the capital costs and the annualized capital costs for the various alternatives considered. Project costs rise sharply for projects deeper than 15 feet since these projects involve the removal of rock. The costs were annualized using the current (FY 99) Federal Discount Rate of 6 7/8 percent and an assumed project life of 50 years.

Table 10

Project Cost Summary

Project Depth	Advance Maint.	Over Depth	Capital Costs	Annualized Capital Costs
-13		-1	$ 1,710,665	$ 122,005
-13	-1	-1	$ 1,766,741	$ 126,004
-14		-1	$ 1,775,605	$ 126,636
-14	-1	-1	$ 1,829,424	$ 130,475
-15	-1	-1	$ 3,561,860	$ 254,032

OPTIMIZATION

During plan formulation a series of project alternatives was defined (see Table 10). One set of alternatives specified 1 foot of allowable over depth and one set of alternatives specified 1 foot of allowable over depth plus 1 foot of advanced maintenance. The inclusion of allowable over depth and advanced maintenance directly links plan formulation to the maintenance dredging cycle. An optimization, which factored in the dredging cycle, was performed to define the NED plan. The optimization centers on the dredging cycle and its relationship to over depth, and advanced maintenance.

Over depth is designed to insure that actual project depths are met. Inclusion of the over depth factor allows construction to "overshoot " project depths by 1 foot. This allowable "overshoot" insures that all portions of the constructed channel are in fact at or below project depth. However, even though a given project depth can be 1 foot deeper than specified, any benefits associated with that potentially deeper depth are not claimable. For example, the 13-foot project with 1 foot of allowable over depth claims the benefits associated with a 13-foot channel and not the benefits associated with a 14-foot channel. This is because the allowable over depth is not a designed depth and in fact may not be 1 foot in all portions of the channel.

Unlike "allowable overdepth" advanced maintenance does effect the annual benefits. For example the 13-foot project with 1 foot of allowable over depth and one foot of advanced

maintenance will have the benefits associated with a 14 foot channel for the first year and the benefits associated with a 13.6 foot channel the second year (4/10ths of a foot of siltation per year) and so on, until maintenance dredging re-establishes the design depth. This is because in the first year the actual designed channel depth is -14 feet MLLW and thus claims the benefits for a -14 foot channel. In the second year siltation reduces the designed channel depth to –13.6 feet. Each year's successive siltation reduces the channels depth and the corresponding benefit, until maintenance dredging reimposes the design depth. This series of declining channel depths creates a tiered benefit schedule over the chosen five year dredging cycle.

The first step towards optimizing channel depth was to create a matrix of benefits vs. depths over time for each alternative. This was accomplished by interpolating the benefits from one depth to the next appropriate depth over the 5 year dredging cycle. Table 11 shows the matrix of benefits vs. depth. The interpolation of benefits to depths used a siltation rate of 4/10ths of a foot and a five year dredging cycle.

Table 11

Total Interpolated Benefits vs. Actual Depths Over 5 Year Dredging Cycle

Period	12+1 MLLW	13 MLLW	13+1 MLLW	14 MLLW	14+1 MLLW	15+2 MLLW
Year 1	$ 249,188	$ 249,188	$ 378,079	$ 378,303	$ 420,242	$ 436,662
Year 2	$ 178,317	$ 178,317	$ 325,465	$ 325,690	$ 402,483	$ 432,180
Year 3	$ 107,447	$ 107,447	$ 272,852	$ 273,076	$ 384,723	$ 427,698
Year 4	$ 59,215	$ 59,215	$ 211,342	$ 211,566	$ 349,769	$ 416,810
Year 5	$ 23,431	$ 23,431	$ 140,704	$ 140,928	$ 297,388	$ 399,283

Once benefits vs. depths were determined, the total tiered schedule of benefits was annualized. A present worth factor was applied to each year's benefit and this stream of benefits was then totaled to reflect the summed benefit over the 5 year dredging cycle. The 5-year capital recovery factor was then applied to this sum to create an annual benefit for each alternative. Table 11a shows the discounted annual benefits for each alternative.

Table 11a

Present Worth of Benefits vs. Alternatives over Dredging Cycle

Present Worth Period	Factor	12+1 MLLW	13 MLLW	13+1 MLLW	14 MLLW	14+1 MLLW	15+2 MLLW
1	0.93567	$ 233,158	$ 233,158	$ 353,758	$ 353,968	$ 393,209	$ 408,572
2	0.87548	$ 156,114	$ 156,114	$ 284,939	$ 285,136	$ 352,367	$ 378,366
3	0.81917	$ 88,017	$ 88,017	$ 223,511	$ 223,694	$ 315,152	$ 350,355
4	0.76647	$ 45,387	$ 45,387	$ 161,988	$ 162,159	$ 268,088	$ 319,472
5	0.71717	$ 16,804	$ 16,804	$ 100,908	$ 101,069	$ 213,276	$ 286,352
Sum of Benefits		$ 539,480	$ 539,480	$ 1,125,104	$1,126,026	$1,542,092	$1,743,118
Capital Recovery Factor (5 yr.)	0.24307	$ 131,131	$ 131,131	$ 273,479	$ 273,703	$ 374,836	$ 423,700

The maintenance cycle also affects the cost side of an optimization. The cost of the maintenance dredging must be allocated over the 5 year dredging cycle so that the annual costs of maintenance are accurately paired with the annual benefits. In this case the maintenance dredging costs were annualized via the appropriate capital recovery factor and then added to the annualized first costs. Table 11b presents the optimization of channel depths.

Table 11b

Economic Optimization

Project Depth	Advance Maintenance	Over Depth	Maintenance Cycle	Annualized Capital costs	Annualized O&M Costs	Total Annual Costs	Total Annual Benefits	Net Benefits	BCR
-13		-1	5	$ 122,005	$ 12,173	$ 134,178	$ 131,131	$ (3,046)	0.977
-13	-1	-1	5	$ 126,004	$ 12,173	$ 138,177	$ 273,479	$ 135,302	1.979
-14		-1	5	$ 126,636	$ 12,173	$ 138,809	$ 273,703	$ 134,894	1.972
-14	-1	-1	5	$ 130,475	$ 12,173	$ 142,647	$ 374,836	$ 232,189	2.628
-15	-1	-1	5	$ 254,032	$ 12,173	$ 266,205	$ 423,700	$ 157,495	1.592

As seen in Table 11b all of the proposed alternatives except for 1 have positive B/C Ratios. However, the 14-foot project with 1 foot allowable over depth and 1 foot of advanced maintenance has the highest Net Benefits. Therefore the NED plan is the 14 + 2 alternative.

UNDERKEEL CLEARANCE AND WITHOUT PROJECT CONDITIONS

The current practice is for vessel operators to operate with a foot or less of underkeel clearance. Several of the local fishermen noted that although it would be difficult to quantify, operating with less than one foot underkeel clearance causes damage to the vessels' rudder.

Furthermore, without proper underkeel clearance, a boat is more difficult to maneuver and the vessel operator is at an increased risk of losing control of the vessel or running aground in a narrow channel.

CONTINUATION OF SUSTAINABLE FISHING ACTIVITIES

According to Ron Warner, Associate Marine Biologist for the California State Department of Fish and Game, the amount of fishing undertaken at Crescent City Harbor will be sustained for the next 20 to 50 years, barring unforeseen circumstances such as disease or changing hydrographic conditions (Figure A). The policy of Fish and Game is to maintain sufficient populations of all species of aquatic organisms. Strict regulations on net size and the length of fishing seasons help maintain fish populations at sustainable levels.

Jim Glock, Marine Biologist for the National Marine Fisheries Service (NMFS) agrees with Warner. NMFS has just completed their annual groundfish management accounts, setting harvest levels and fishing restrictions for 1997. In Glock's words:

"It is often difficult to predict, due to changes in the number of vessels competing for the resources, changes in the oceanic environment and other factors, the populations of fish. The fishery is expected to remain near current levels, with annual or cyclical variations. Management of whiting has been quite conservative and is based on a relative abundance of scientific information. Rockfish (genus Sebastes) species, including many nearshore species, have been heavily harvested in recent years. Rockfish are typically long-lived with low annual reproductive rates. Thus harvest rates must be kept very low. An analogy might be old growth forest management; when one tree (or fish) is removed, it may take 20 to 30 years or longer for a similar tree/fish to replace it. Available biological data are inadequate to provide very precise estimates of abundance of many rockfish species, and even trends are difficult to discern. A recent assessment of rockfish off the West Coast indicates biologically acceptable harvest levels should be reduced from previous estimates. This may not affect the amount of fish actually harvested, however, because "quotas" have not been achieved. Either the fish have been unavailable, or markets have not provided incentive to harvest them.

"Recently, however, rockfish markets have been developed or improved, especially for fish caught with hook-and-line (HKL) gear rather than trawls. As mentioned previously, vessels using HKL gear are typically smaller than those using trawls. We do not expect increased harvests of these species. They are likely to decline, perhaps substantially. "Another major fishery in the region is for Dover sole, thorny heads, and sablefish. These three species are taken together by trawlers, while HKL vessels target sablefish almost exclusively. Recent stock assessments have shown general declines in these species, but data and assessment methods have been the subject of increased controversy. New assessments are planned in 1997."

"Overall, the commercial fishery has been in a process of fishing most stocks down to levels we hope are sustainable over the long term. Thus, recent catch levels are probably better indicators of long term yields, as opposed to using the average of the past 10 or 20 years. Some evidence might show declines in abundance of various species are at least partly due to long term changes in ocean conditions; warm water conditions have prevailed since the mid-1970s. This situation appears to have moderated recently, which would result in cooler water and "friendlier" environment for species that do better in colder water. At this point, this is somewhat speculative, and assuring current levels to continue may be more prudent. The goal of fishery management is to maintain healthy stocks at levels that will support an economically viable fishing industry."

Both State and Federal resource agencies help corroborate the assumption that the economic activity will be sustained and that the fishing industry will not be adversely affected by a project defined by the deepening of the Crescent City Harbor Channel.

SENSITIVITY ANALYSIS

The key factor in determining the NED benefits in this study is harvest costs. These costs of operation are the metric by which the federal interest is determined. As such it becomes important to asses the probability of these cost changing substantially and thereby changing the level of NED benefits attributable to project implementation.

Harvest costs consist of a great many variables and as such could be subject to different shocks. These shocks would usually be supply related. A large component of harvest costs are fuel related, as fuel prices rise so will the cost of production. Conversely if fuel prices fall the cost of production will fall. Because harvest costs have a large number of factors, which determine overall cost of production, an econometric model would have to be used to project with any level of certainty future harvest costs and the probability of these costs becoming fact.

Such an econometric model is beyond the scope of this study. However, the sensitivity of project justification to harvest costs can be modeled. A simple chart can illustrate different harvest costs and the effect they will have on project justification. As can be seen below when harvest costs rise the Benefit to Cost Ratio increases. As these costs rise the project becomes more beneficial. This is because the resources used to harvest the product have become increasingly more valuable. Therefore any project which allows less of these expensive resources to be used will actually increase project benefits. Conversely, if harvest costs fall the resources used to harvest the product become less valuable, and therefore any project which increases efficiency has less of a beneficial impact on the national economy.

This report has attempted to model as closely as possible, given limited information, the actual costs of production. As it turns out there can be relatively large swings in the harvest cost without adversely affecting project justification.

Table 12 shows the change in the B/C ratio of the 14+2 alternative resulting from changes in the harvest costs of the Crescent City fishing fleet.

Table 12
Sensitivity Analysis
14+2 Alternative

Percentage Change in Harvest costs	Net Benefits		BCR
-50 percent	$	74,280	1.521
+50 percent	$	480,910	4.371

As can be seen in the above table the harvest cost can fluctuate rather dramatically and the project will still retain a positive Benefit to Cost Ratio.

CRESCENT CITY HARBOR NAVIGATION PROJECT
FINANCIAL ASSESSMENT OF THE HARBOR DISTRICT
MAY 1999

PURPOSE & SCOPE:

The objective of this analysis is to conduct a financial assessment of the local sponsor for the Crescent City Harbor Deepening Project. The analysis is based on the guidelines provided by ER 1105-2-100, which the Corps uses to determine the local sponsor's credibility. The Crescent City Harbor District, "Harbor District", is the non-Federal sponsor for the project and is responsible for ensuring that non-federal funds are provided as needed to meet the construction schedule.

The sponsor's debt history and financial condition were based on the recent independent auditor's reports of the Harbor District dated December 11, 1997.

PROJECT COSTS:

The total construction cost of the Crescent City Harbor Deepening Project is estimated to be $1,829,000 based on an March 1999 estimate and a channel depth of -14 feet Mean Lower Low Water (MLLW). Although the project was authorized in 1965, the section of the project did not have a contract for physical construction awarded before 17 November 1986 (EP 1165-2-1). Therefore, the cost sharing guidelines of Water Resources Development Act (WRDA) of 1986 apply. Title I-Cost Sharing, Section 101. Harbors states in part: "

(a) Construction

Payments during construction--the non-Federal interests for a navigation project for a harbor or inland harbor, or any separable element thereof, on which a contract for physical construction has not been awarded before the date of enactment of this Act shall pay, during the period of construction of the project, the following costs associated with general navigation features:

10 percent of the cost of construction of the portion of the project which has a depth not in excess of 20 feet;

(2) Additional 10 percent payment over 30 years--the non-Federal interests for a project to which paragraph (1) applies shall pay an additional 10 percent of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, at an interest rate determined pursuant to Section 106. The value of lands, easements, rights-of-way, relocations, and dredged material disposal areas provided under Paragraph (3) shall be credited toward the payment required under this paragraph."

Based on this, the local sponsor's share is approximately $45,000 (above what they have already contributed), which includes a credit for lands, easements, rights-of-way, relocations and disposal areas. The construction cost sharing is scheduled to begin on or before September 30, 1998. The following table presents the estimated cost sharing between the Federal government and the Harbor District.

Estimated Cost Sharing
For Selected Plan

Item	*Total Cost*	% Fed.	Federal Cost	% Non-Fed.	Non-Federal Cost
Real Estate					
Lands&Damages	*$67,000*	77%	$51,700	23%	$15,000
LERRDS	*$145,000*	100%	$145,300	0%	$0
Nav, Ports & Harbors					
Mob/Demob Cost	*$294,000*	100%	$294,000	0%	$0
Dredging Mud	*$209,000*	89%	$185,000	11%	$24,000
Adv. Main Dredging	*$53,000*	89%	$47,000	11%	$6,000
Land Disp Site Prep	*$265,000*	100%	$265,000	0%	$0
Aids to Navigation	*$16,000*	100%	$16,000	0%	$0
Plan,Eng & Design	*$700,000*	100%	$700,000	0%	$0
Construction Mgmt	*$80,000*	100%	$80,000	0%	$0
Total Cost Crescent City Harbor	*$1,829,000*		$1,784,000		$45,000

Source: Crescent City Harbor General Reevaluation Report--Table 8.1, Section 8, Appendix A, Engineering Analysis

FINANCING CAPABILITY:

Harbor District

The Crescent City Harbor District was created as a result of the State Harbor and Navigation Code. Enacted in the 1930's, the Code grants Harbors to authority to levy taxes to finance maintenance of harbor projects. The Harbor District began operations in 1935 and consists of five elected commissioners and 10 employees. Services provided by the District include improvement and operation of the harbor, and construction, maintenance, and operation of wharves, docks, piers, slips, quays, and other facilities for the promotion and accommodation of commerce, navigation, fisheries, and public recreation. It is financed through property taxes, boat slip rentals, harbor

services, as well as launching and wharfage fees. Since the Board members are publicly elected, they have the decision-making authority to levy taxes, designate management, and attend the primary fiscal matters of the District.

Long Term Debt

Long-term debt consists of several loan agreements between the District and the California Department of Boating and Waterways. The Harbor District repays the loans through revenues within the boundaries of related project areas. To the extent that net revenues generated from within project areas are insufficient, the District is obligated to levy and collect taxes. As of June 30, 1997, the long-term debt totaled $1,008,820.

Assessment

According to independent auditor's reports for the years 1996-97, the local sponsor has sufficient cash reserves and assets to finance its cash portion of the Crescent City Deepening Project. The Harbor District reported a net increase in cash of from investment interest, grants, taxes and assessments. Its long-term debt is reasonable for an agency of comparable size. And while Del Norte County reported higher than average unemployment in recent years (as shown in Economic Analysis), it is a growing county with a growing tax base.

APPENDIX C

REAL ESTATE PLAN

REAL ESTATE PLAN
CRESCENT CITY HARBOR
DEL NORTE COUNTY, CA

1. GENERAL PROJECT DESCRIPTION

a. This appendix represents the real estate requirements for the Crescent City Harbor Project. The purpose of the project is to improve navigation in the Citizen's Dock and Small Boat Basin access channel in Crescent City Harbor. This would provide a channel with a consistent depth from the Small Boat Basin to the existing deeper Federally maintained Inner Harbor Channel. This would eliminate tidal delays, safely accommodate larger vessels, and increase the efficiency of the harbor. In summary the project would consist of deepening and maintaining the channel to adequate depths. Regarding the referenced Federal channel, there are two existing Federally maintained navigation channels. There is the Entrance Channel, which begins at the outer breakwater, and the Inner Harbor Channel, which the Entrance Channel connects to. The access channel from the Inner Harbor Channel to Citizen's Dock and the Small Boat Basin, which is the subject of this report, was authorized as part of these previous Federal projects but was not constructed. There was no requirement for any interests in land for these projects, because the channels were dredged from the water and the material was placed in an ocean disposal site. Therefore, the sponsor has not received credit for any lands contribution, and thus there is no necessity to reduce the value of the required interests for crediting purposes.

b. The authority for this study is contained in the Crescent City Harbor Navigation Project, Del Norte County, California, which was authorized by the Rivers and Harbors Act of 1965 (PL 89-298), which modified the then existing project authorized by the Rivers and Harbor Act of 1945 and previous acts. A Reconnaissance Report was prepared and approved in 1995. Since an authority to dredge the access channel area already existed, the feasibility phase was dispensed with and approval to proceed directly to Planning, Engineering, and Design (PED) by preparing a General Reevaluation Report (GRR) was granted.

2. GENERAL DESCRIPTION OF THE AREA, PROJECT, AND TOTAL ACREAGE TO BE ACQUIRED

a. The project area is located at the Crescent City Harbor in Crescent City, County of Del Norte, California. The area is north of Anchor Road and south of Sunset Circle, between U.S. Highway 101 and the Pacific Ocean. Crescent City is approximately 370 miles north of San Francisco, 330 miles south of Portland, Oregon, 89 miles south of Grants Pass, Oregon, and 81 miles north of Eureka, California.

b. The recommended plan for this project is to dredge an extension channel 1,200 lineal feet in length and from a minimum width of 140 feet to a maximum of 210 feet near the existing Federal channel to the entrance of the Small Boat Basin. Although the dredge material is considered suitable for aquatic disposal, the Environmental Protection Agency (EPA) requires

studies for a Section 102 permanent site designation. The San Francisco District and South Pacific Division have acknowledged the need for a Section 102 permanent site that will require an Environmental Impact Statement (EIS). Because of the high cost and lengthy time it takes to pursue an EIS, it is considered more economical and timely to dispose of the material from the construction of the project at the proposed upland site than to pursue the EIS and designated ocean site for the project purposes. However, there is a Plan of Action for the EIS and designated ocean site for the future O&M disposal. There is anticipated to be approximately 60,000 cubic yards of O&M dredged material in the future from the two present channels in addition to another 16,000 cubic yards from the proposed project.

c. Dredging would be accomplished using a 12-inch cutter head hydraulic dredge and directly pumping the dredged material via 3,500 feet of pipeline to the upland disposal area. The dredged material will be spread by a dozer at the disposal site. The disposal site is owned and operated by the sponsor. It is located just north of the Small Boat Basin. The site is 311,018 square feet in size. There will be a capacity of approximately 63,000 cubic yards available at this site upon completion of the proposed disposal site improvements. The amount of dredged material to be disposed of at the upland site is 38,000 cubic yards. The dredging of the channel has been evaluated at three depths. The first depth is -15 feet MLLW with two feet of overdepth, the second is -14 feet (MLLW) with one-foot overdepth, and the third is -13 feet (MLLW) with one-foot overdepth.

d. The real estate requirements for this project consider the three depth evaluations. These requirements consist of an upland disposal site for placement of the dredged material, a pipeline to transport the material directly to the disposal site, a construction staging area, and a road or access route to haul any rocky material that cannot be transported through the pipe to the disposal site for a total of 9.88 acres. The required real estate is all located at Crescent City Harbor, which owned by the sponsor. There are no special value considerations or crediting principles that are applicable to the required LERRs.

Project	Estate/Duration	SF/Acreage	Estimated Value
Disposal Site	*TWAE (1 yr.)	311,018 SF	$77,755
Pipeline	Pipeline Esmt (1 yr.)	16,553 SF	4,138
Staging Area	TWAE (1 yr.)	46,174 SF	11,544
Road	Road Esmt (1 yr.)	56,628 SF	14,157

*Temporary Work Area Easement

3. ESTATES

a. The non-Federal sponsor will acquire the minimum interests in real estate that will support the construction and subsequent operation and maintenance of the project. The estates described

in the previous section of this report support the real estate requirements. Approval of non-standard estates for the use of the disposal site, pipeline, and road are required. The standard estate for the disposal site is fee, and we are requesting the non-standard estate of a temporary work area easement for one year. The standard estates for the pipeline and road are a permanent pipeline easement and a permanent road easement; and we are requesting approval of temporary easements (one year) for these. The one-year temporary easements are determined adequate for the construction, operation, and maintenance of the project. This determination was made upon assurances from the San Francisco District that the disposal of the dredged material for the project will require no more than one year for placement of material at the proposed disposal site. They are validating this in the main report, along with providing a Plan of Action for the new ocean disposal site where the future O&M material will be placed. Any change in the project plan formulation that would indicate a use for longer than one year or uncertainty as to the acquisition of an ocean disposal site for O&M, would demand a real estate requirement of the standard estate of fee and permanent easements. In such a case, the increased costs for the permanent land interests would make this project economically unjustified.

4. NAVIGATION SERVITUDE

The work to be performed in the deepening of the channel is within the navigation servitude. There are no other lands required for the project that lie below the ordinary high water mark, or the mean high water mark of the navigable waters. There is, therefore, no navigation servitude issue in this project.

5. PUBLIC LAW 91-646, The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended by Public Law 100-27

There are no relocation costs included in the project as required by Public Law 91-646.

6. NON-FEDERAL SPONSOR'S ABILITY TO ACQUIRE

The non-Federal sponsor, the Crescent City Harbor District, does not have a real estate staff. This is of no consequence for the purposes of this project, however, since there are no real estate acquisitions required for this project. The real estate rights are all on sponsor-owned land. The sponsor will provide an Authorization for Entry and Attorney's Certificate As To Authorization for Entry, executed by their authorized representatives.

7. BASELINE COST ESTIMATE

The non-Federal sponsor prepared their estimate of acquisition costs and schedules based on their knowledge of project requirements and anticipated staffing and resource levels. The Appraisal Branch of the Sacramento District Real Estate Division prepared the gross appraisal in January 1997 upon which the land cost estimates are based. An Administrative Appraisal Update, July 1999, confirms the land cost estimates determined in the gross appraisal, dated January 1997, still apply in 1999. All lands, regardless of ownership, have been estimated at fair

market value. The differences between State and Federal appraisal rules have been considered. There is no difference between the application of State and Federal rules in the valuation of the lands to be acquired.

Baseline Cost Estimate

Project	Non-Federal	Federal	*Land (LERRDS)	Project Cost
Crescent City	$15,000	51,700	145,300	$212,100
Project Total	$15,000	51,700	145,300	$212,100

***Includes Lands, Damages, and Contingencies**

8. PROJECT MAP

A project map is included as Exhibit B.

9. MINERALS

There are no valuable minerals impacted by this project. There was, therefore, no enhancement for mineral deposits included in the baseline cost.

10. ACQUISITION SCHEDULE

The Acquisition schedule is included as Exhibit A.

11. FACILITY AND UTILITY RELOCATIONS

There are no facility or utility relocations in this project.

12. HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE

No hazardous, toxic, or radiological waste (HTRW) was noted by the appraiser in the process of completing the gross appraisal. It should be noted that the appraiser is not qualified to detect hazardous waste and/or toxic materials and that any comment by the appraiser that might suggest the possibility of the presence of such substances should not be taken as a confirmation of the presence of hazardous waste and/or toxic materials. Therefore, this subject was discussed with the Corps of Engineers representative responsible for HTRW issues in this project. It was thus confirmed, after a diligent study of the material, that there are no HTRW concerns in this project.

Real Estate Plan

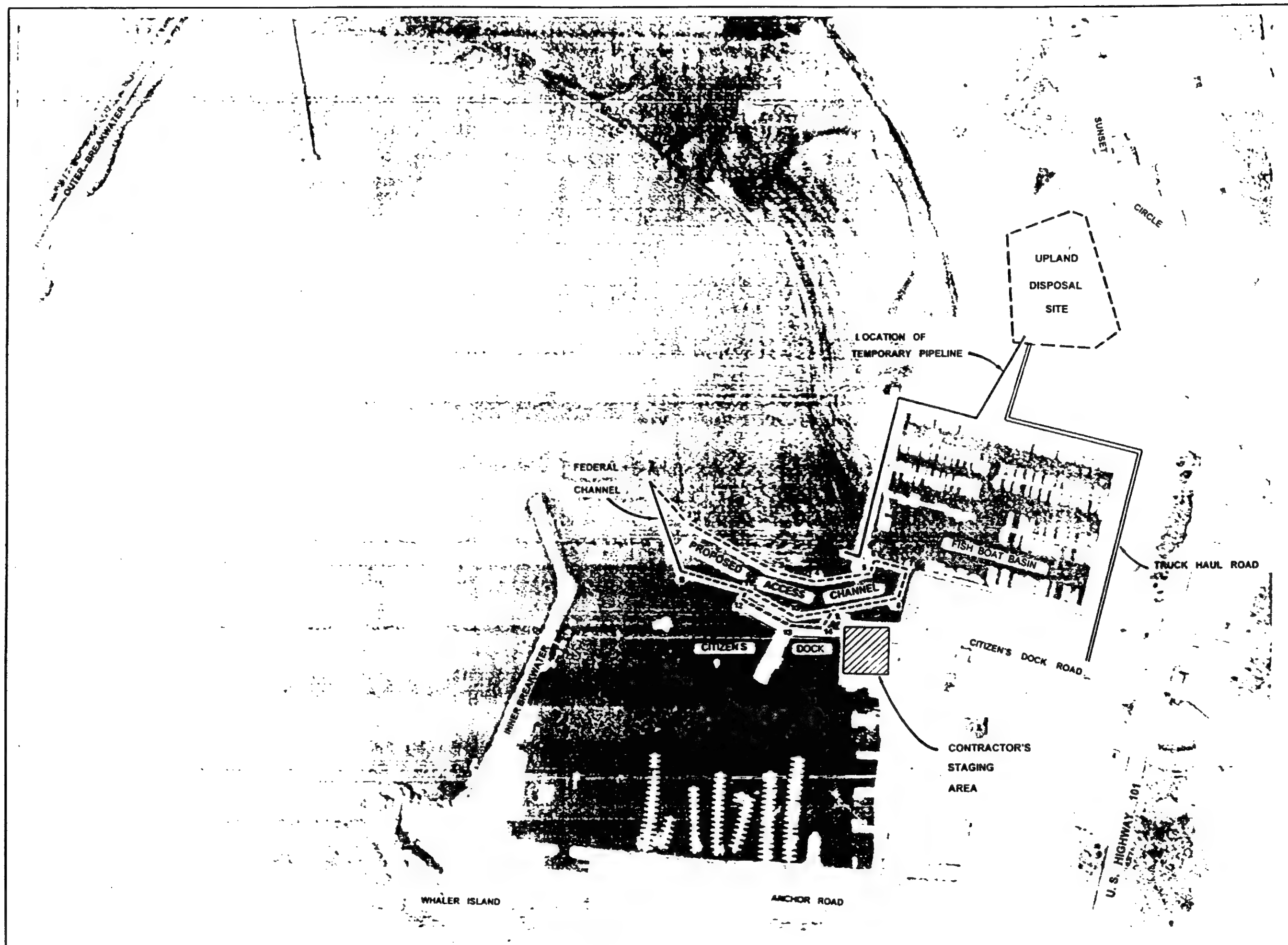
Real Estate Milestones

Crescent City Harbor Project	COE* Start	COE* FINISH	NFS* START	NFS FINISH
Execution of PCA		10/99		10/99
Landowner Meetings Conduct	N/A		N/A	
Prepare/Review Mapping & Legal Descriptions			N/A	N/A
Obtain/Review Title Evidence			N/A	N/A
Obtain/Review Tract Appraisals			N/A	N/A/
Conduct Negotiations	N/A		N/A	
Perform Closings	N/A		N/A	
Prepare/Review Condemnations	N/A		N/A	
Perform Condemnations	N/A		N/A	
Obtain Possession	N/A		N/A	
Complete Review PL91-646 Benefits Relocations	N/A		N/A	
Conduct/Review Facility & Utility Relocations	N/A		N/A	
Certify All Necessary LERRDs Are Available for Construction	09/99	10/99		
Prepare and Submit Credit Requests			01/00	01/00
Review/Approve or Deny Credit Requests	02/00	02/00		
Establish Value for Creditable LERRD in F&A Cost Accounting System	02/00	02/00		

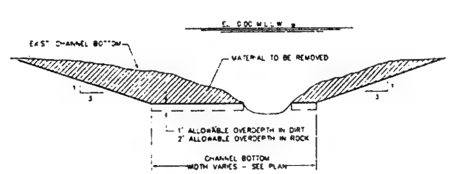
*** COE - Corps of Engineers**

***NFS - Non-Federal Sponsor**

EXHIBIT A



CHANNEL ANGLE POINTS		
Angle Points	North	East
B	885,907.50	1,403,719.25
1	886,007.92	1,403,284.28
2	886,049.00	1,403,540.21
3	886,303.10	1,403,984.37
4	886,434.00	1,404,110.31
5	886,669.85	1,404,210.44
6	886,711.00	1,404,177.00
7	886,828.00	1,404,300.00
8	886,723.00	1,404,385.00
9	886,429.38	1,404,260.61
10	886,258.40	1,404,188.17
11	886,135.40	1,403,973.17
12	886,092.00	1,403,995.00
13	886,215.00	1,404,213.00
14	886,341.00	1,404,302.00



TYPICAL ACCESS CHANNEL DREDGING SECTION
NOT TO SCALE

SYMBOL | DESCRIPTION | DATE | APPROVAL

REVISIONS

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY:
CHECKED BY:
DESIGNED BY
SUBMITTED

DEL NORTE CO. CALIFORNIA
CRESCENT CITY HARBOR GRR
LOCATION OF
PROPOSED ACCESS CHANNEL
AND UPLAND DISPOSAL SITE

APPROVAL RECOMMENDED
APPROVED
DATE

PREPARED UNDER THE DIRECTION OF
RICHARD B. THOMPSON
LT. COLONEL C.E., DISTRICT ENGINEER

SCALE
SHEET

FINAL

ENVIRONMENTAL ASSESSMENT, BIOLOGICAL ASSESSMENT AND CONSISTENCY DETERMINATION

CRESCENT CITY HARBOR FEDERAL CHANNEL EXTENSION AND DEEPENING GENERAL RE-EVALUATION REPORT CRESCENT CITY HARBOR DEL NORTE COUNTY, CALIFORNIA

AUGUST 1999

Prepared By:

UNITED STATES ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT PLANNING BRANCH
333 MARKET STREET
SAN FRANCISCO, CA 94105-2197

1.O PURPOSE OF AND NEED FOR ACTION

1.1 Background Information

Pursuant to the National Environmental Policy Act (NEPA) of 1969, this Environmental Assessment (EA) has been prepared by the United States Army Corps of Engineers (COE) San Francisco District to identify any possible direct, indirect and/or cumulative significant impacts to the human environment resulting from the proposed Federal channel extension, deepening and maintenance dredging at the Crescent City Harbor Basin located at Crescent City Harbor, Del Norte County, California. This document also serves as a Biological Assessment pursuant to Section 7 of the Endangered Species Act of 1973.

The Crescent City Harbor District has indicated a need to deepen and maintain an access channel with a consistent depth from the Small Boat Basin to the deeper federally maintained Inner Harbor Channel to eliminate tidal delays, accommodate larger vessels, and increase the efficiency of the harbor. The Harbor District is seeking Federal assistance to complete this project. In addition to the Federal project, the Harbor District also plans to deepen the berthing area between the proposed channel and Citizen's Dock to project depth.

There are currently two federally constructed and maintained navigation channels at Crescent City Harbor (see Figure 1). The 15-foot deep Inner Harbor Channel extends for 1500 feet along the inside and around the tip of the inner breakwater, where it connects to the 20-foot deep Entrance Channel, a 200 foot wide channel that extends 2,600 feet to the outer breakwater. The Crescent City Harbor District has dredged a 16-foot access channel between the Inner Harbor Channel and the Small Boat Basin, but has been unable to maintain it to the depth necessary because their equipment is unable to keep up with shoaling.

Historically, both existing Federal channels have been maintenance dredged about every five years by the Federal government with disposal of the material at SF-1, an EPA interim dredged material ocean disposal site. The last time the channels were maintained in 1998, the dredged material was placed in the intertidal zone at Whaler Island. The Crescent City Harbor District continually maintains the access channel and other sections of the harbor. The locally dredged material (about 9,500 cubic yards per year) is presently being disposed of at a Harbor District owned upland disposal site adjacent to the small boat basin. Historically, Whaler Island and South Beach have been used for deposition of this material. However, dredged material disposal to South Beach ceased in 1992 pursuant to Waste Discharge Order Number 92-103 issued by the California Regional Water Quality Control Board, North Coast Region (RWQCB) based upon the lack of sediment testing. The average annual shoaling of the harbor and entrance channel is estimated to be between 80,000 and 100,000 cubic yards (cy)(26). However, the actual amount dredged by the Federal Government has been considerably less than the above average (i.e., 40,000 cys was dredged from these channels in September 1993).

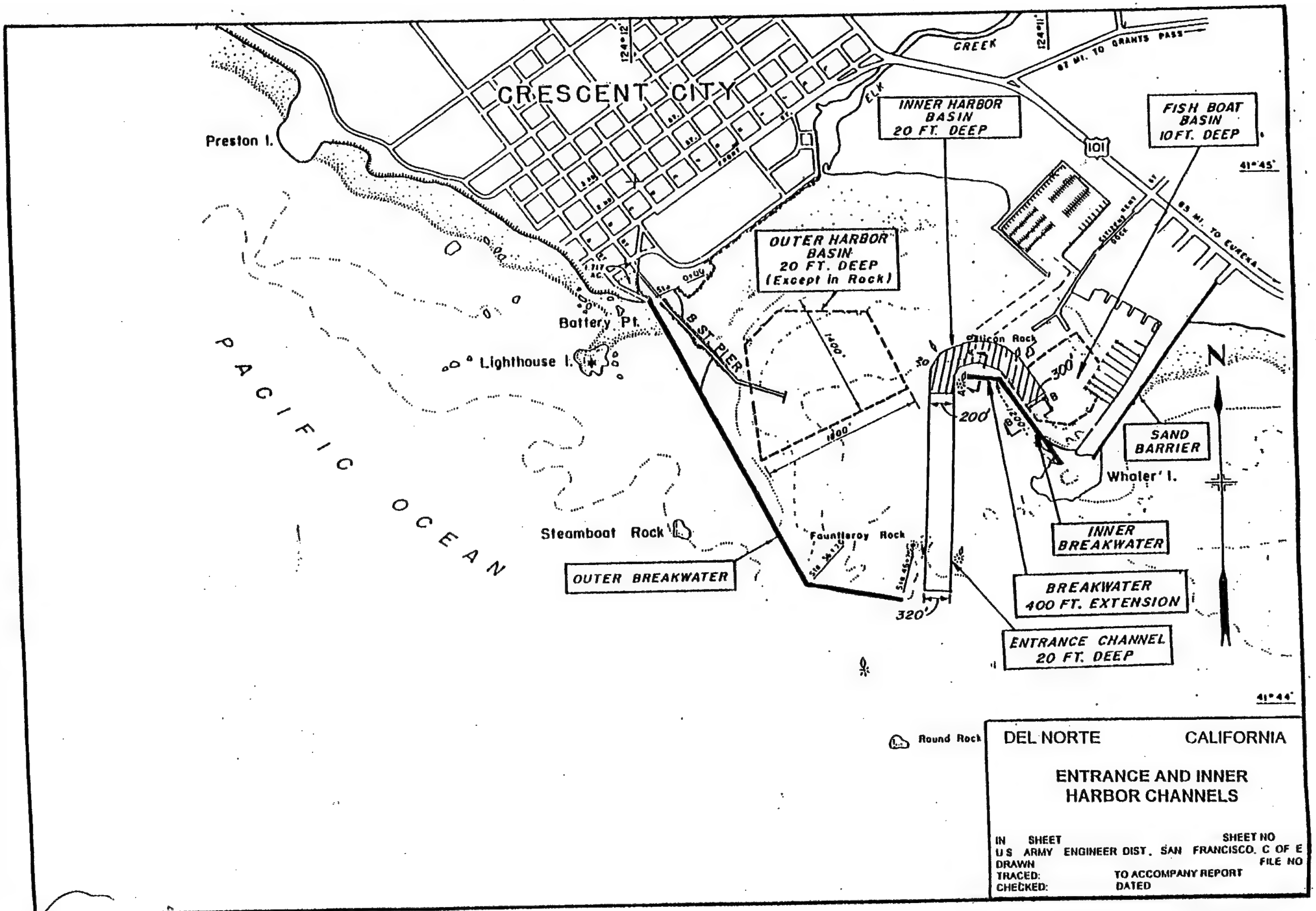

CRESCENT CITY
CREEK
ELK
87 MI. TO GRANTS PASS
85 MI. TO EUREKA
101
124°12'
124°11'
41°45'
41°44'
Preston I.
Battery Pt.
Lighthouse I.
PACIFIC OCEAN
Steamboat Rock
Fauntleroy Rock
Whaler' I.
Round Rock
N
B ST. PIER
INNER HARBOR BASIN 20 FT. DEEP
FISH BOAT BASIN 10 FT. DEEP
OUTER HARBOR BASIN 20 FT. DEEP (Except in Rock)
SAND BARRIER
INNER BREAKWATER
BREAKWATER 400 FT. EXTENSION
ENTRANCE CHANNEL 20 FT. DEEP
OUTER BREAKWATER
1400'
1800'
200'
300'
320'
DEL NORTE CALIFORNIA
ENTRANCE AND INNER HARBOR CHANNELS
IN SHEET
SHEET NO
U S ARMY ENGINEER DIST. SAN FRANCISCO. C OF E
FILE NO
DRAWN
TRACED:
CHECKED:
TO ACCOMPANY REPORT
DATED

FIGURE 1.

1.2 Need for Improvements

The Harbor District currently maintains the access channel, the Small Boat Basin, and the Citizen's Dock berthing areas on a limited scale. The Harbor District is unable to adequately maintain the access channel due to the speed at which the channel shoals combined with the inefficiency of their dredge plant.

Commercial fishing vessels are experiencing navigational difficulties at the access channel to the Small Boat Basin due to the limited channel depth. The access channel and berths at Citizen's Dock frequently shoal to intolerably shallow depths. Over the years, the shoaling problem has worsened, restricting access for fishing vessels, particularly for the large boats, which must work with the tide. The restricted channel depth results in delays and vessel damages to the larger boats. In addition, when the tide delays the larger boats, they sometimes tie up at Citizen's Dock, limiting access to the harbor's fuel and ice facilities and creating delays for smaller vessels.

Because the shoaling rate is much less inside the Small Boat Basin, the Harbor District does not have a problem maintaining the Small Boat Basin to adequate depths. The controlling problem is their inability to deepen and maintain the rapidly shoaling access channel.

The project would be designed to reduce direct delays to larger vessels that occur at low tides. The project would also reduce the delays to other fishing boats using the facilities at Citizen's Dock caused by the berthing of large boats that cannot enter the Small Boat Basin. The project would deepen the existing access channel and transfer its maintenance from the Harbor District to the Federal Government.

2.0 PROJECT DESCRIPTION AND ALTERNATIVES

2.1 The Proposed Action

The proposed structural alternative is to dredge an approximately 1,200 foot long access channel from the federal Inner Harbor Channel to the entrance of the Small Boat Basin (see Figure 2). The channel bottom width would range from 140 feet to 210 feet where it would flare to meet the Inner Harbor Channel. This flare is designed to facilitate the navigation through the turn from the Inner Harbor Channel. The turn and entrance into the Small Boat Basin would be as wide as the existing boat basin levees would permit. The channel sideslopes would be excavated with a one-foot vertical to three-foot horizontal ratio. The non-Federal portion of the project consists of deepening the area between the proposed Federal Channel and the northwest side of Citizen's Dock. This portion is defined in Figure 2 as the area between points nine through fourteen.

This channel design would provide a minimum two-way traffic plan in the access channel, which is the minimum acceptable channel configuration, and most closely resembles current channel operation.

Economic optimization resulted in a design depth of -14 feet mean lower low water (MLLW) plus one foot of advanced maintenance and a one-foot overdepth allowance. Other depths considered were -15 feet with a two-foot overdepth allowance, accounting for the presence of rock, and -13 feet with a one-foot overdepth allowance.

The actual dredging method is anticipated to be a hydraulic operation. The material itself is expected to be mostly sandy with small amounts of broken rock (less than 10%). Some shale and graywacke may be encountered in the deeper portion of the channel and a cutter-head dredge may be required.

The quantity of material to be dredged varies according to the above different channel depth alternatives ranging from 16,200 to 42,500 cy, with the preferred plan producing 37,670 cy.

The dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site.

Maintenance dredging of the access channel would be performed on a five-year cycle and would remove an average of 16,000 cubic yards of dredged material per cycle. The present two federal channels and the proposed project channel would be combined in one maintenance operation producing an estimated average quantity of 66,000 cy of O&M dredged material every five years. The anticipated disposal site for maintenance dredged material is SF-1 which would first require designation by the U.S. Environmental Protection Agency as an ocean disposal site under Section 102 of the Marine Protection Research and Sanctuaries Act of 1972 (MPRSA). Limited quantities of maintenance dredged material deemed acceptable for beach nourishment could be

placed at Whaler Island.

2.2 Anchorage Area

The alternative of developing an anchorage area for larger vessels was discussed with the Local Sponsor. Development of an anchorage area for the largest vessels using the harbor would provide an out of the way place for these vessels to await tide conditions allowing safe navigation. This would prevent the indirect tidal delays to smaller vessels caused by traffic congestion at Citizen's Dock. The cost of an anchorage area for 32 large vessels may be less than that of constructing an access channel.

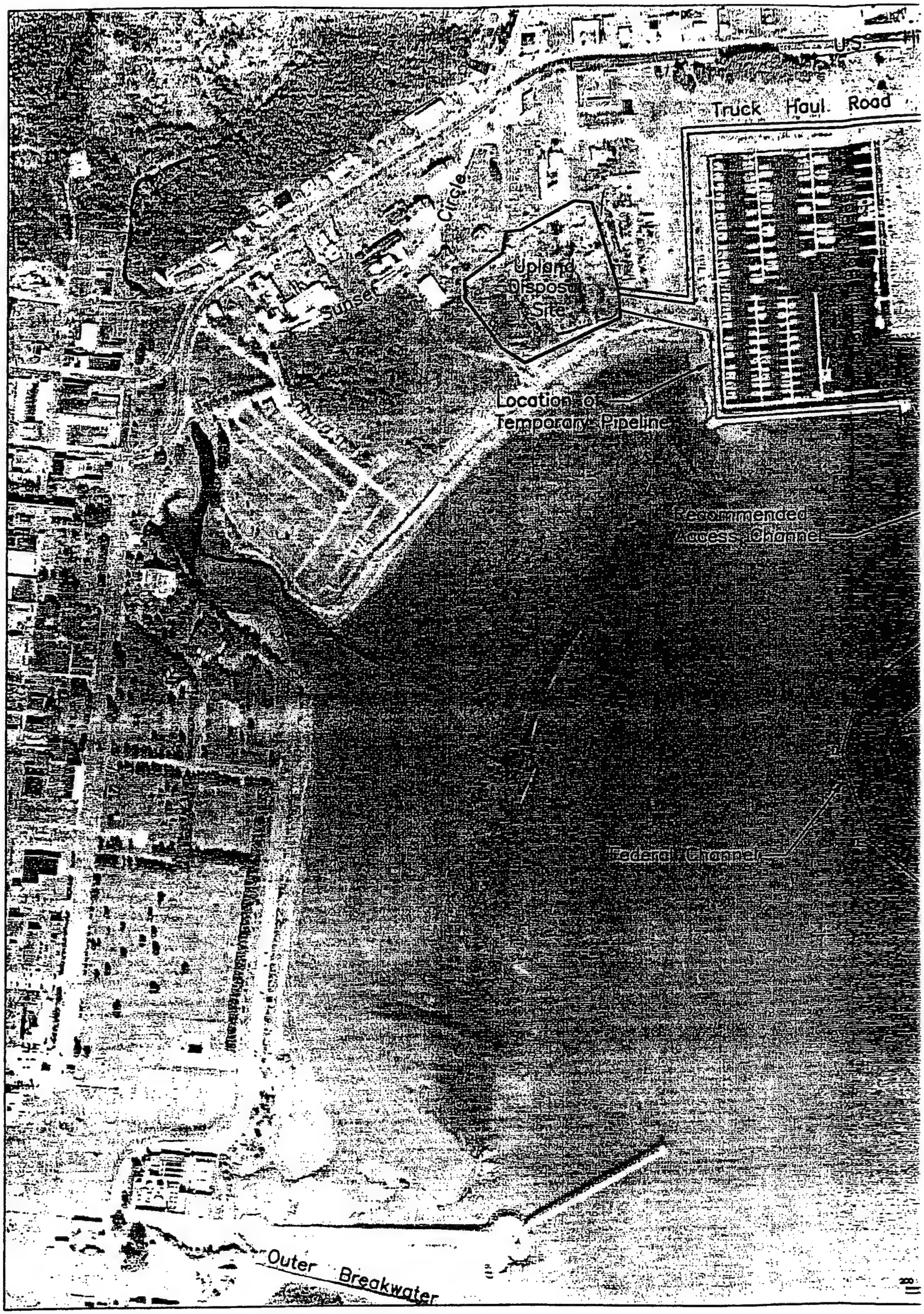
The development of an anchorage area within the outer harbor area was determined to be infeasible based on Local Sponsor input. The reasons for this determination are that the outer harbor; (1) is exposed to severe wind and wave conditions; (2) has shallow depth and rapid shoaling rates which would result in substantial maintenance dredging requirements; (3) would generate safety concerns due to possible infringement of anchorage areas on the entrance channel; (4) and an anchorage area, while eliminating some of the indirect delays to smaller vessels, would not eliminate delays to larger vessels, and in some cases could actually increase delays to these larger vessels. Consensus was reached that further evaluation of this alternative was not warranted.

2.3 No Action

No action would mean that the Federal Government would not improve the subject channel. If the no action alternative were selected, the harbor area would continue to be ineffectively dredged by the Harbor District and experience the problems listed in Section 1.2. The resident commercial and recreational maritime related industries would be adversely impacted and the overall economy of the Crescent City area would continue to decline (42).

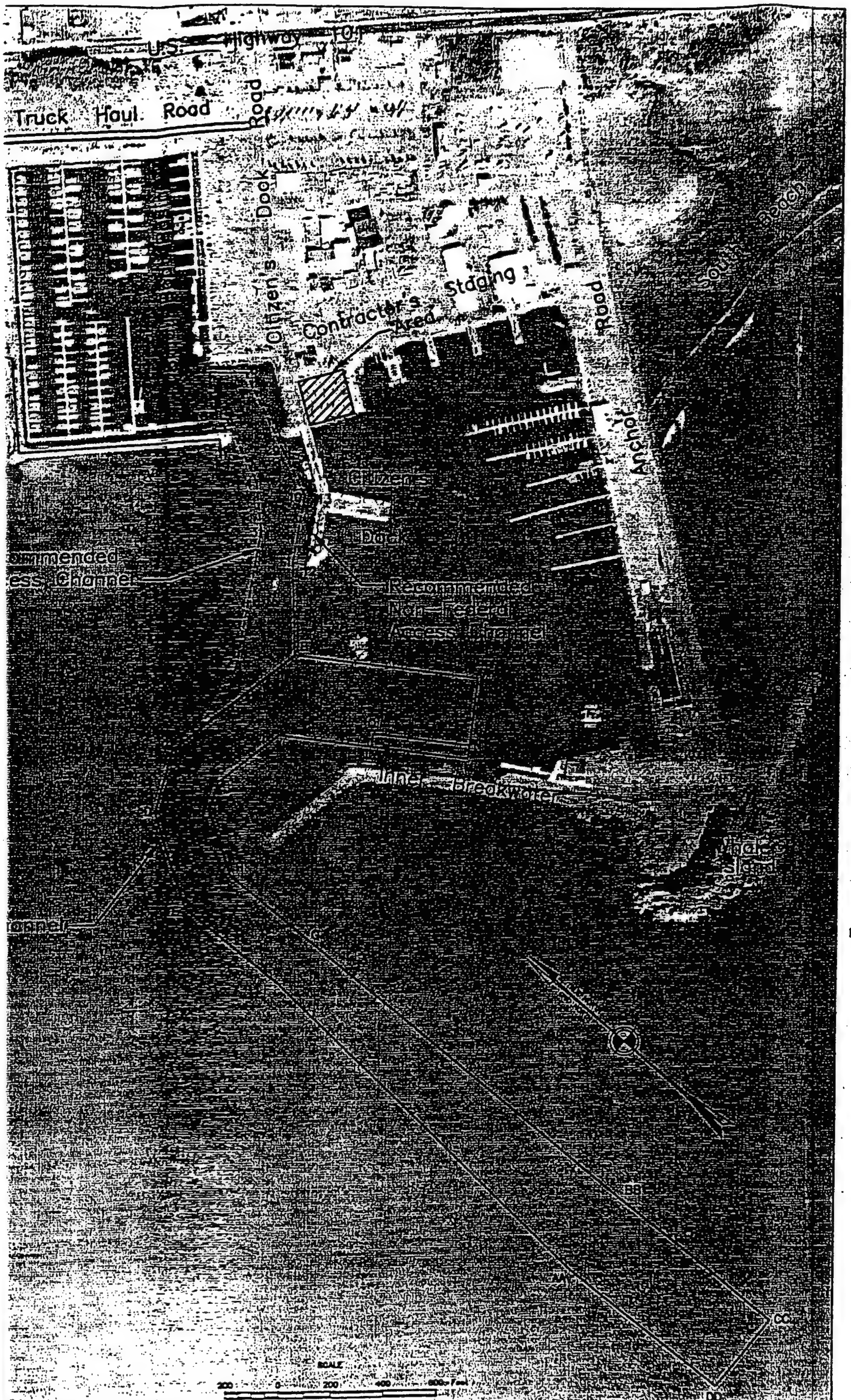
2.4 Disposal Alternatives

Ocean Disposal at SF-1. SF -1 is centered at 41° 43' 15" North, 124° 12' 10" West, about 1.25 miles to the southwest of the harbor. The 0.19 square nautical mile site is 914 meters in diameter and consists of fine sand and protruding rock pinnacles at a depth of about -90 feet MLLW. The disposal of dredged material from Crescent City Harbor into ocean waters has been on going for years (before the 1940s)(21). Since the 1970s, SF-1 has been used as a project specific interim dredged material disposal site in conjunction with past Federal O&M projects, pursuant to Section 103 of the MPRSA. Section 103 designation for this site expired in 1997. Dredged material proposed for ocean disposal must be evaluated for suitability in accordance with provisions under this law. The Corps is currently preparing an action plan to have the EPA designate SF-1 as a permanent site under Section 102 of this act. Section 102 designation would require the preparation of an EIS addressing the impacts of disposal and a site monitoring and



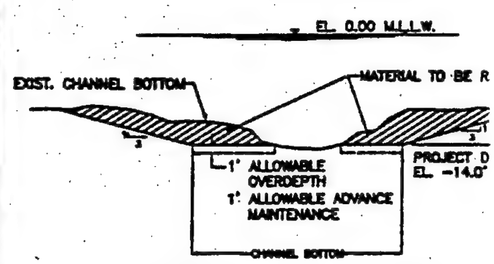
Truck Haul Road
Circle
Sunset
Upland Disposal Site
Location of Temporary Pipeline
Recommended Access Channel
Federal Channel
Outer Breakwater

(1)



RECOMMENDED CHANNEL POINTS		
POINT	NORTH	EAST
1	886,007.92	1,403,284.28
2	886,049.00	1,403,540.21
3	886,303.10	1,403,984.37
4	886,434.00	1,404,110.31
5	886,669.85	1,404,210.44
6	886,711.00	1,404,177.00
7	886,828.00	1,404,300.00
8	886,723.00	1,404,385.00
9	886,429.38	1,404,260.81
10	886,258.40	1,404,188.17
11	886,135.40	1,403,973.17
12	886,092.00	1,403,998.00
13	886,215.00	1,404,213.00
14	886,341.00	1,404,302.00

FEDERAL CHANNEL POINTS		
POINT	NORTH	EAST
A	885,320.00	1,404,100.00
B	885,907.50	1,403,719.25
C	886,037.97	1,403,154.12
D	885,940.16	1,402,934.90
E	885,623.01	1,402,744.40
F	885,173.16	1,402,755.60
G	885,173.16	1,402,955.60
H	885,569.54	1,402,945.78
I	885,783.11	1,403,073.85
J	885,828.05	1,403,174.33
K	885,762.63	1,403,455.34
L	885,467.45	1,403,647.08
M	885,156.92	1,403,848.20
N	885,181.10	1,403,890.17
O	885,491.63	1,403,689.03
AA	883,637.04	1,402,660.10
BB	883,645.00	1,402980.00
CC	882,945.22	1,402,997.42
DD	882,937.25	1,402,677.52



TYPICAL ACCESS CHANNEL
DREDGING SECTION
N.T.S.

REVISIONS

U.S. Army ... of Engine...
San Francisco

DRAWN BY: S. O.

DEL NORTE COUNTY

CRESCENT CITY HABOR GR...
LOCATION OF
PROPOSED ACCESS CHAN...
AND UPLAND DISPOSAL S...

PREPARED UNDER THE DIRECTION OF
RICHARD G. THOMPSON
LT. COLONEL, C.E., DISTRICT ENGINEER

PLAT...

FIGU...

(2)

RECOMMENDED CHANNEL POINTS		
POINT	NORTH	EAST
1	886,007.92	1,403,284.28
2	886,049.00	1,403,540.21
3	886,303.10	1,403,984.37
4	886,434.00	1,404,110.31
5	886,669.85	1,404,210.44
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FEDERAL CHANNEL POINTS		
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D	885,940.16	1,402,934.90
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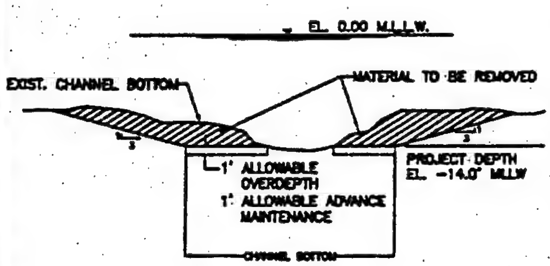
F	885,173.16	1,402,755.60
G	885,173.16	1,402,955.60
H	885,369.54	1,402,945.78
I	885,783.11	1,403,073.85
J	885,828.05	1,403,174.33
K	885,762.63	1,403,455.34
L	885,467.45	1,403,647.06
M	885,158.92	1,403,848.20
N	885,181.10	1,403,890.17
O	885,491.63	1,403,689.03
AA	883,637.04	1,402,660.10
BB	883,645.00	1,402980.00
CC	882,945.22	1,402,997.42
DD	882,937.25	1,402,677.52



TYPICAL ACCESS CHANNEL
DREDGING SECTION
N.T.S.

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U.S. Army Corps of Engineers
San Francisco District

DRAWN BY: S. D.
CHECKED BY:
DESIGNED BY:
SUBMITTED:

DEL NORTE COUNTY — CALIFORNIA

CRESCENT CITY HABOR GRR
LOCATION OF
PROPOSED ACCESS CHANNEL
AND UPLAND DISPOSAL SITE

APPROVAL RECOMMENDED: — APPROVED: — DATE:

PREPARED UNDER THE DIRECTION OF
RICHARD G. THOMPSON
LT. COLONEL, C.E., DISTRICT ENGINEER

SCALE: — JOB NO.: — DRAWING NUMBER — SHEET

PLATE 3

FIGURE 2

3

management plan. This site was removed from consideration for the proposed deepening, as it would not be designated in time. However, this site is still being considered as the primary site for the placement of maintenance dredged material.

Upland Disposal. The Crescent City Harbor District owns and operates an upland disposal site for dredged material located just north of the Small Boat Basin. A pipeline dredge would be used to transport the dredged material 1600 feet to the upland disposal site. The site's current remaining capacity is approximately 27,000 cy according to a Corps photogrammetric survey conducted in October 1998. Presently, the 7.1 acre disposal site's use is reserved for material from the Harbor District's dredging operations. The present disposal site would require modification to accommodate the new construction dredged material. The levee height would be increased by two to three feet resulting in a uniform levee crest elevation of 19 feet MLLW (See Figure 3 and Figure 4). Material presently within the disposal site would be used to raise the levee. The levee would be constructed entirely from the interior of the site. No construction would take place outside the in-place levees.

Beach Nourishment at Whaler Island. Beach nourishment behind the groin at Whaler Island was also considered as a disposal site. This site has been used in the past for disposal of dredged material with physical and chemical characteristics that are suitable to beach nourishment. The material eventually re-enters the littoral drift. The site currently has limited capacity since 70,000 cy of maintenance dredged material from the Outer Harbor Channel was placed there in 1998. Sediment testing results have shown that most of the material to be dredged by the proposed project has an organic content and grain size distribution that are unacceptable for use in beach nourishment. For this reason, and due to limited space, this site is not being considered further as a disposal site for the construction of the channel. The site could be considered for disposal of maintenance dredged material in the future providing the material has suitable characteristics.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 General

Crescent City Harbor is located on the Northern California coast about 280 nautical miles north of San Francisco and about 17 miles south of the Oregon border (see Figure 5). The harbor is located on the south edge of a broad marine terrace bordered on the south and west by the Pacific Ocean and on the north and east by densely forested coastal mountains. Marine oriented commercial and recreational industries are the primary uses for the harbor area. The environs are dominated by agriculture, tourism, and the lumber industry.

The harbor's naturally crescent-shaped beach is bound by a 4,700-foot long rubblemound outer breakwater to the west, a 2,400-foot long sand barrier to the east, and a 1,600-foot rubblemound inner breakwater to the south. The harbor's opening faces south and is about 2,000 feet across.

The most prominent geographic feature of the harbor is Whaler Island, which reaches an elevation of 70 feet above MLLW. Although historically an island, it is now joined to the sand barrier and inner breakwater. The harbor bottom is an irregular rock surface, with numerous pinnacles projecting above the water's surface. Near the harbor entrance the bottom material tends to be sand, with finer grained sediments found in other parts of the harbor.

The only surface drainage entering the harbor is Elk Creek, located at the north end of the harbor. Its watershed covers approximately 4.8 square miles (3,091 acres) and is composed of predominantly low-density suburban development and pasturelands.

The Del Norte Coast in general experiences moderate temperatures averaging 46°F in January and 58°F in August. Severe storms, winds and squalls occur frequently along the coast, particularly during the winter months. Heavy fog occurs in this area during the summer months. The average precipitation is 70 inches per year.

The proposed project would not impact the area's geography, climate, or hydrology.

Past dredging activities at Crescent City have shown the impacts having the greatest possibility of significantly affecting the human environment are: Water Quality, Fish and Wildlife, Endangered/Threatened Species, Cultural Resources, and Commercial/Recreational Fisheries.

3.2 Water Quality

Water quality parameters that could be temporarily affected by dredging operations include: total suspended solids (turbidity), dissolved oxygen, nutrients, pH, salinity, and temperature.

As part of the *Dredge Disposal Study for San Francisco Bay and Estuary,* conducted by the

Corps, the effects on the water column by operation of a hopper, hydraulic cutterhead, and clamshell dredge were determined. This study revealed that dredging operations did not typically cause significant fluctuations in salinity, temperature, or pH over the short or long term.

Dissolved oxygen concentrations tend to decline in the vicinity of dredging operations when the suspension of anoxic sediment creates high biological and chemical oxygen demand. Dissolved oxygen levels in the immediate vicinity of the Crescent City Harbor dredging would decline for very short periods of time. Due to the short duration of the effect, impacts of depressed levels of dissolved oxygen in the water column would be insignificant.

Turbidity effects vary with the material being dredged and the type of dredge employed. Gravel and sand settle out quickly, whereas silts may remain in suspension for up to several hours. In addition to the suspended sediments, nutrient enrichment caused by potential elevated concentrations of phosphorus and nitrogen in the dredged material may increase water turbidity by increasing primary production.

Dredging and disposal operations have the potential to re-suspend bottom sediments containing trace amounts of petroleum, pesticides and heavy metals, which could then enter the hydrologic/biologic systems.

Dredging would be performed using a hydraulic-cutterhead dredge. The amount of sediment suspended by this method is vastly reduced compared to a clamshell dredge. Pipelines that extend from the harbor bottom to the upland site all but eliminate mid-water and surface plumes. Suspended materials are restricted to the immediate vicinity of the cutter. Therefore, effects of dredging activities on turbidity, depressed dissolved oxygen, and released contaminants from suspended sediments would be minimal and confined to the immediate area.

No significant impacts to water quality due to lowered dissolved oxygen concentrations, increased turbidity, release of contaminants, changes in pH, salinity, or temperature would be expected with the access channel deepening project.

3.3 Sediment Testing Results

The Corps has tested and reviewed recent (9/96) test data to assess suitability for disposal at the designated upland dredged material disposal site located just north of the small boat basin. In our view, based upon review of the data, the project material is suitable for placement at the designated site.

Cored samples of project material were subjected to physical and chemical analyses in bulk in order to characterize contamination. In addition, samples of the material were subjected to a Modified Elutriate Test which is a prescribed test generating a water extract of dissolvable substances from the sediment. This laboratory constitutes a kind of worst case simulation or indication of the character of impounded dredged slurry water so that one may assess effects of

runoff or discharge. Battelle Marine Laboratory analyzed the samples. The chemical categories were metals, chlororganics, PAHs, Butylytins (see Appendix A).

Of the metals, nickel and chromium are notable in that the levels are in several hundreds mg/kg. While generally somewhat elevated, the levels are unexceptional in the Crescent City area. The elutriate values show that the bulk nickel did not detectably contribute to dissolved nickel while chromium contributed approximately 1 ug/l (ppb), an insignificant level.

Chlorinated pesticides were detected at very low levels. Aldrin was found to be present at 0.6 to 1.7 ug/g. The DDT breakdown product, 4.4'-DDE was found at 2 to 3 ug/g. At 1 to 2 ng./l detection limit (parts per trillion), aldrin was not detected in elutriate, while a low measurable level, 3 ng/l of 4,4'-DDD was measured in elutriate. PCBs were not detectable in either bulk or elutriate. PAHs were found at levels of tens of ppbs in bulk sediment, not detected in elutriate except for ubiquitous phenanthrene at the barely detectable value of 17 parts per trillion. PAH values fall in to the normal background range.

In summary, given the low contamination character of the project material, the insignificant biological activity of the disposal site, and the insignificant contamination levels indicated by the elutriates for fluid discharge, we do not expect significantly adverse environmental effects due to placement of this material at the designated upland disposal site.
Federal Statutes and Regulations

3.4 Air Quality Analysis

Federal Statutes and Regulations

The objective of the Clean Air Act is to protect and enhance the quality of the air resources within the U.S., and to protect public health from both long and short-term air contaminant exposure. Under this Act, the EPA Administrator has established a set of ambient air quality standards. In California, the Air Resources Board has established additional standards that are in some cases more stringent than those set by EPA. As in all states, California has prepared and is the primary enforcing authority for the State Implementation Plan (SIP), which is a blueprint for achieving and maintaining the national and state ambient air quality standards.

Section 118(a) of the Clean Air Act provides that all federal agencies, including the Corps of Engineers, are subject to all state and local laws, regulations, and standards for air pollution control, provided the State and local laws are at least as stringent as those at the federal level, and provided they have not been set aside by federal courts. Section 176(c) of the Act provides that no federal agency shall engage in any activity that does not conform to an EPA-approved SIP. Those requirements must be met by obtaining all necessary permits and approvals from state and local agencies prior to the start of project work.

The 1990 Clean Air Act amendments require federal agencies that are proposing projects to complete an analysis to determine whether the project conforms to the approved SIP. The EPA promulgated final guidelines on preparation of the conformity analysis in 1993. The EPA final rule does not require a conformity analysis for proposed projects that are in attainment areas for national ambient air quality standards. At present, Del Norte County is in attainment for all national standards and it is therefore not necessary to make a formal determination that the proposed project conforms to the SIP (Robert Torzynski, North Coast Unified Air Quality Management District, NCUAQMD, personal communication).

State Statutes and Regulations

The California Clean Air Act of 1988 (Health & Safety Code §40918 et seq) requires areas in non-attainment for the State ozone and carbon monoxide standards to adopt a plan for attainment of those standards by the earliest practical date. Areas which are non-attainment for PM_{10}, sulfates, lead, H_2S, or visibility are not required to develop attainment plans under this act. Inasmuch as the North Coast Air Basin is in attainment for all criteria pollutants except PM_{10}, the NCUAMQD has not adopted an attainment plan for pollutants other than PM_{10}.

Local Regulations

The NCUAQMD regulates stationary sources of air pollution within the North Coast Air Basin (Del Norte, Trinity, and Humboldt counties). They have overall responsibility to ensure that the State Implementation Plan for stationary and mobile sources is enforced within this air basin. The district has adopted and the California Air Resources Board has approved several air quality enforcement rules. Those which apply to the Crescent City Harbor project are summarized below (Robert Torzynski, NCUAQMD, letter):

> Rule 130 (s2): Definition of Significant Emission Rates – Lists the emissions limits in tons/year and lb/day for new or modified stationary sources. The lb/day limits apply only to Mendocino County. Although the limits apply to one source only, they were used in this air quality assessment as a guide for estimating the significance of individual and aggregate emissions from the several sources involved in the harbor extension and deepening.
>
> Rule 200: Permit Requirements – Defines review procedures for new sources requiring permits. Sets forth pre-construction requirements for Best Available Control Technology for new stationary sources.
>
> Rule 400: Public Nuisance – Provides that a person shall not discharge air contaminants which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public.
>
> Rule 410: Visible Emissions – Sets forth standards for emissions which reduce

atmospheric visibility. There is an express exemption for visibility reductions caused by atmospheric water vapor.

Rule 420: Particulate Matter - Provides that particulate matter emissions from combustion sources shall not exceed 0.46 grams per standard cubic meter of exhaust gas or in excess of Rule 490 New Source Performance Standards.

Rule 430: Fugitive Dust Emissions - Provides set of mitigations normally required to prevent particulate matter from becoming airborne including coverings, hoods, and application of water or oil to exposed earth surfaces during construction.

Rule 440: Sulfur Oxide Emissions - Limits sulfur dioxide emissions from a single source to a concentration not to exceed 1,000 ppm or the specific emissions limits set forth in Rule 490 New Source Performance Standards, as applicable.

Air Quality Setting

Climate and Meteorology

The climate of Del Norte County is one of cold, very rainy winters with cool, foggy, and nearly rainless summers near the coast. For most of the year, the project area near Crescent City receives a continuous supply of moisture-laden air from the Pacific Ocean, with prevailing onshore airflow providing good air quality conditions. Air stagnation is rarely a problem, but is most frequent in late summer, early fall, and in advance of warm fronts which often precede winter storm systems. Convective precipitation and thunderstorms are rare.

Infrequently, conditions conducive to poor air quality occur in the North Coast Air Basin when a high-pressure dome of air causes the formation of a deep temperature inversion and highly stable conditions. This may occur in any season, but is most frequent in the summer half of the year when the North Pacific storm track has shifted well to the north of the region and the sub-tropical high pressure ridge in the Eastern Pacific dominates the weather for most of the state. Because of the generally continuous supply of marine air and the high incidence of low clouds and fog during much of the year in coastal Del Norte County, there is little potential for the formation of photochemical smog. (Robert Torzynski, NCUAQMD, personal communication, 1997).

Air Quality Baseline

Air quality is measured by calculating concentrations of atmospheric pollutants. Concentrations can be expressed in parts per million (ppm) or micrograms per cubic meter (ug/m^3). The federal and state air quality standards set the maximum allowable concentrations of pollutants at which the public health and welfare are protected. EPA has published the federal standards that are referred to as National Ambient Air Quality Standards (NAAQS), while the State of

California Air Resources Board has established the California Ambient Air Quality Standards (CAAQS). The current standards are listed in Table 1. Project emissions are considered significant if they either 1) cause a state or federal ambient air quality standard to be exceeded, or 2) exceed the emissions limits established by the local air pollution control district, i.e., the NCUAQMD).

Table 1. Federal and California Ambient Air Quality Standards
(all units in parts per million except as noted)

Pollutant	Averaging Time	California Standards	National Standards Primary	National Standards Secondary
Ozone	1-hour	0.09	0.12	0.12
Carbon Monoxide	8-hour	9	9	-
	1-hour	20	35	-
Nitrogen Dioxide	Annual	-	0.053	0.053
	1-hour	0.25	-	-
Sulfur Dioxide	Annual	-	0.03	-
	24-hour	0.04	0.14	-
	3-hour	-	-	0.5
	1-hour	0.25	-	-
Particulate Matter	Annual	30 μg/m³	50 μg/m³	50 μg/m³
(PM_{10})	24-hr	50 μg/m³	150 μg/m3	150 μg/m³
Sulfates	24-hour	25 μg/m³	-	-
Lead	30-day	25 μg/m³	-	-
	Quarterly	-	1.5 μg/m³	1.5 μg/m³
Hydrogen Sulfide	1-hour	0.03	-	-
Vinyl Chloride	24-hour	0.010	-	-
Visibility	8-hour (10 AM B 6 PM)	*	-	-

* In sufficient amount to produce an extinction coefficient of 0.23 per km from particulate matter w/ relative humidity < 70% (ARB Method V).

The federal Environmental Protection Agency designates all areas of the United States as having air quality better than or worse than the national ambient air quality standards. The former areas are called attainment and the latter are non-attainment areas. Existing background air pollution concentrations in Del Norte County and in the Crescent City area are low (Robert Torzynski,

personal communication , 1997). The NCUAQMD, including Del Norte County, is currently designated as an attainment area for the national and state ambient air quality standards, which means that the standards have not been exceeded. The one exception is that the region is in non-attainment for the state standard for particulate matter.

The air pollutants addressed in this analysis, in addition to odor, are those for which the NCUAQMD has established peak daily and annual emissions significance thresholds: carbon monoxide (CO), oxides of nitrogen (NO_X), sulfur dioxide (SO_2), particulate matter smaller than 10 microns in diameter (PM_{10}), and reactive (or volatile) hydrocarbons. The NCUAQMD also has significance thresholds for several other air pollutants, but none of these others will be emitted during the proposed dredging and associated project operations.

Ozone and other related oxidants are colorless gases formed in the lower atmosphere as a result of chemical reactions between oxygen, volatile organic compounds and nitrogen oxides in the presence of sunlight. Ozone is a respiratory irritant and can cause damage to lung tissue.

NOx as emitted from internal combustion engines have no serious direct adverse health effects, but the gaseous compounds formed in the atmosphere from NOx emissions may be harmful. One of the gases resulting from atmospheric chemical reactions is nitrogen dioxide. It produces an irritating odor, and also is a respiratory irritant that can cause lung tissue damage. NOx also acts to facilitate the formation of photochemical smog (oxidants) in combination with reactive hydrocarbons and sunlight. Because of the prevailing cool, cloudy conditions most of the year in Del Norte County, the conditions for the formation of and build-up of photochemical smog rarely occur.

SO_2 is a colorless, nonflammable gas with a pungent odor that is mainly produced by combustion of sulfur-containing fossil fuels and is a by-product of crude oil refining. It is a respiratory irritant.

CO is a clear, odor-free gas created by incomplete combustion of fossil fuels as well as organic substances. Automobile exhaust is the largest source of CO. It is not a respiratory irritant but in high concentrations it may interfere with the transfer of oxygen into the blood. Exposure to CO can produce symptoms such as dizziness, headache and, in extreme cases, loss of consciousness. The CO standards are expressed in terms of a high 8-hour average and a high 1-hour value. When CO standards are exceeded, it is most often along high-volume line sources, such as freeways, or at locations where vehicles frequently must idle for long periods. The CO standard is most likely to be exceeded during periods of stagnant, cold weather in winter.

PM_{10} is solid material from smoke, dust, fly ash and condensing vapors that may be suspended in the atmosphere for extended time-periods. Industrial processes, motor vehicles, woodsmoke from open burning and residential heating, and dust from construction projects and agricultural operations are the major sources of particulate matter. It can cause respiratory disease and lung damage.

Sensitive Receptors

The impact of emissions to the most sensitive members of the population and to sensitive plants and animals is of concern. Sensitive receptors include children, the elderly, those with chronic respiratory ailments, and some types of cultivated plants, e.g., orchids. The Crescent City Harbor District drying yard for dredged material, which will be renovated for disposal of the dredged material from the deepening, is located about 0.2 mile north of the Small Boat Basin and just west of U.S. Highway 101. There are no sensitive receptors (e.g., hospitals, schools, day-care centers, or convalescent homes) within one mile of the immediate harbor or the disposal site. A Holiday Inn is located within 0.1 mile east of the disposal site on the west side of U.S. Highway 101, and there are a few small businesses located along Sunset Circle, a short street which located about 0.2 miles north of the drying yard (Lindsay Marks, Crescent City Harbor Master, personal communication, 1998). Inasmuch as the prevailing sea breeze along this portion of the coast is from the northwest, these receptors are not expected to experience appreciable adverse effect from project emissions including nuisance odors from the dredged material in the drying yard, when the prevailing onshore marine air rapidly disperses emissions from the dredged material in the drying yard. During brief periods of air stagnation (normally occurring in late summer, fall, and early winter) the possibility exists for sensible odors from the dredge material to reach homes and businesses within the immediate project area (0.5 mile radius). Whether these would constitute a nuisance depends on the subjective perception of the individuals involved.

Air Quality Impacts

Significant Emissions Criteria

This impact analysis includes emissions for each piece of equipment based on the estimated fuel consumption or horsepower for each engine using the emission factors from AP-42, *Compilation of Air Pollutant Emission Factors, Vol I - Stationary Sources*, EPA, 1985 (w/supplements to Sep 1988). The analysis includes 1) estimates of peak 24-hr emissions both for disposal site renovation and dredging operations, 2) total project emissions for the entire 45-days for disposal site renovation and for the eleven-day period for dredging operations. The daily and total project emissions can then be compared to the NCUAQMD criteria for determination of significance. Site renovation and dredging operations cannot occur simultaneously, and the emissions from each operation are to be compared separately for the 24-hr significance criteria.. Table 2 contains the NCUAQMD criteria for significant emissions (Robert Torzynski, 1997).

Table 2. Criteria for Significant Emissions

(Rule 130 - North Coast Air Quality Management District)

Air Contaminant	Significant Emission Rate tons/year	lb/day
Carbon monoxide	100	550
Nitrogen oxides	40	220
Sulfur dioxide	40	220
Total particulate matter	25	135
PM_{10}	15	80
Ozone(Reactive Hydrocarbons)	40	220

The pounds/day emission limits in Table 2 apply only to Mendocino County, but were used in this assessment as an indicator of significance for emissions by individual pieces of equipment used in project operations. The emissions in lb/day given in Tables 6 and 7 represent the calculated emissions using the fuel consumption and AP-42 emission factors. For dredging operations, this assumes the equipment is operating for the entire 24 hours and that both primary and secondary engines are operating simultaneously on the dredger and also on the boats.

Based on the emissions calculations in Tables 6, 7 and 8, significance criteria for total project and 24-hour emissions would not be exceeded for any pollutant except for NO_X.

Table 3. Crescent City Harbor - Air Quality
Fuel Consumption by Equipment Type[1]

Equipment Type	Horsepower	Engine Fuel Factor	Fuel Consumption Gal/hr
Hydraulic Dredge			
Primary Engine	625	0.045	28.1
Elect. Generator	50	0.045	2.3
Second. Engine	210	0.039	8.2
Work Tugboat			
Primary Engine	100	0.045	4.5
Second Engine	25	0.039	1.0
Survey Boat			
Primary Engine	100	0.045	4.5
Secondary Engine	40	0.039	1.6
Derrick			
Primary Engine	100	0.011	1.1
Secondary Engine	25	0.011	0.3
Barge	10	0.011	0.1
D8 Dozer	335	0.04	13.4

1. Fuel Consumption = HP X Eng. Fuel Factor.

Table 4. Emission Factors by Equipment Type Dredging Operations (lb/1000 gal fuel)[7]							
	Pollutant						
	NO_x	CO	SO_2	PM	PM_{10}[1]	HC[2]	RHC[3]
Equipment Type							
Hydraulic Dredge[4]	469.0	102.0	31.2	33.5	32.2	37.5	36.0
Derrick[4]	469.0	102.0	31.2	33.5	32.2	37.5	36.0
Barge[4]	469.0	102.0	31.2	33.5	32.2	37.5	36.0
Work Tugboat[5]	407.5	70.2	28.5	33	31.7	45.7	43.9
Survey Boat[5]	407.5	70.2	28.5	33	31.7	45.7	43.9
D8 Dozer[6]	284.9	78.5	31.1	25.3	24.2	27.6	26.5

1. Particulate matter < 10 microns (96% of total PM)
2. Total hydrocarbons
3. Reactive hydrocarbons (96% of total)
4. AP-42, Table 3.3-1, Vol I, Part 1, EPA 1985.
5. Humboldt Harbor Feasibility Report, Table 2. 1995.
6. AP-42, Table II-7.1, Vol II, EPA 1985.
7. Abbreviations: NOx = Total oxides of nitrogen; CO = carbon monoxide; SO_2 = sulfur dioxide; PM = particulate matter.

Table 5. Emission Factors by Equipment Type Disposal Site Renovation (lb/hr)[2]							
	Pollutant						
	NO_x	CO	SO_2	PM	PM_{10}	HC	RHC
Equipment Type							
Haul Trucks[1]	4.90	15.40	0.00	2.34	1.64	3.70	3.55
Dozer - 600hp	10.30	2.83	1.12	0.91	0.87	0.99	0.95
Dozer - 100hp	1.72	0.47	0.19	0.15	0.15	0.17	0.16
Scraper	1.26	0.35	0.14	0.17	0.16	0.12	0.12
Roller	0.86	0.30	0.07	0.05	0.05	0.07	0.07
Loader	1.89	0.57	0.18	0.17	0.16	0.04	0.04
Crane -60 ton-310hp	9.57	2.07	0.63	0.68	0.65	0.76	0.73
Hydr. Excavator (Backhoe) 250hp	7.72	1.67	0.51	0.55	0.52	0.61	0.59
Motor Grader	0.71	1.54	0.09	0.06	0.06	0.04	0.04

1. Haul trucks equipped w/ heavy duty gasoline engines (worst case emissions) gm/mile (AP42, pages H-48, H-50 Appendix H). All other disposal site equipment diesel powered.

2. Abbreviations: NOx = Total oxides of nitrogen; CO = carbon monoxide; SO = sulfur dioxide; PM = particulate matter.

Table 6. Crescent City Harbor Deepening - Air Quality Peak Daily Emissions- Dredging Operations (lb/dy)							
	Pollutant[2]						
	Nox	CO	SO_2	PM	PM_{10}	HC	RHC
Equipment Type							
Hydraulic Dredge	434.48	94.49	28.90	31.03	29.83	34.74	33.35
Derrick	15.76	3.43	1.05	1.13	1.08	1.26	1.21
Barge	1.13	0.24	0.07	0.08	0.08	0.09	0.09
Work Tugboat	53.79	9.27	3.76	4.36	4.18	6.03	5.79
Survey Boat	59.66	10.28	4.17	4.83	4.64	6.69	6.43
D8 Dozer	91.62	25.25	10.00	8.14	7.78	8.88	8.52
Total	656.44	142.95	47.96	49.56	47.60	57.69	55.39
Emissions limits[1]	220.00	550.00	220.00	135.00	80.00	——	220.00

1. North Coast Unified Air Quality Management District significant emissions rate (24-hr rates apply only to Mendocino Co.)
   No emissions limit for total hydrocarbons.
2. All equipment operating 24hrs continously (worst case). Actual effective operating time is expected to be about 60 percent, allowing for pumping interruptions such as vessel passing, moving the dredger and other down-time.

Table 7. Crescent City Harbor Deepening - Air Quality Peak Daily Emissions- Disposal Site Construction (lb/dy)							
	Pollutant						
	No_x	CO	SO_2	PM	PM_{10}	HC	RHC
Equipment Type[2]							
Haul Trucks	1.08	3.40	0.00	0.52	0.36	0.82	0.78
Dozer - 600hp	82.40	22.64	8.96	7.28	6.96	7.92	7.60
Dozer- 100hp	13.76	3.78	1.50	1.22	1.16	1.32	1.27
Scraper	10.08	2.80	1.12	1.36	1.28	0.96	0.96
Roller	6.88	2.40	0.56	0.40	0.40	0.56	0.56
Loader	15.12	4.56	1.44	1.36	1.28	0.32	0.32
Crane -60 ton-310hp	76.56	16.56	5.04	5.44	5.20	6.08	5.84
Hydr. Excavator (Backhoe) 250hp	61.76	13.36	4.08	4.40	4.16	4.88	4.72
Motor Grader	5.68	12.32	0.72	0.48	0.48	0.32	0.32
Total	273.32	81.82	23.42	22.45	21.28	23.18	22.37
Emissions limits[1]	220.00	550.00	220.00	135.00	80.00	—	220.00

1. North Coast Unified Air Quality Management District significant emissions rate (24-hr rates apply only to Mendocino Co.)
No emissions limit for total hydrocarbons.
2. All equipment operating maximum 8-hr/dy except haul trucks, which carry to the site a total of 125 CY/dy.
Each truck holds 12.5 CY w/ a 10-mile round trip from the borrow area. Therefore 10 individual trips/dy X 10 mi/trip = 100 mi/dy total all trucks.

Table 8. Crescent City Harbor Deepening - Air Quality
Total Project Emissions by Equipment Type (lb)[1]
Dredging Operations & Site Construction

	Pollutant						
	Nox	CO	SO_2	PM	PM_{10}	HC	RHC
Equipment Type							
Dredging Operations							
Hydraulic Dredge	4779.30	1039.42	317.94	341.38	328.13	382.14	366.85
Derrick	173.34	37.70	11.53	12.38	11.90	13.86	13.31
Barge	12.38	2.69	0.82	0.88	0.85	0.99	0.95
Work Tugboat	591.69	101.93	41.38	47.92	46.03	66.36	63.74
Survey Boat	656.24	113.05	45.90	53.14	51.05	73.60	70.70
D8 Dozer	1007.86	277.70	110.02	89.50	85.61	97.64	93.75
Disposal Site Equip.							
Haul Trucks	48.62	152.81	0.00	23.22	16.22	36.71	35.22
Dozer - 600hp	3708.00	1018.80	403.20	327.60	313.20	356.40	342.00
Dozer- 100hp	619.20	170.14	67.33	54.71	52.30	59.52	57.11
Scraper	453.60	126.00	50.40	61.20	57.60	43.20	43.20
Roller	309.60	108.00	25.20	18.00	18.00	25.20	25.20
Loader	680.40	205.20	64.80	61.20	57.60	14.40	14.40
Crane -60 ton-310hp	3445.20	745.20	226.80	244.80	234.00	273.60	262.80
Hydr. Excavator (Backhoe) 250hp	2779.20	601.20	183.60	198.00	187.20	219.60	212.40
Motor Grader	255.60	554.40	32.40	21.60	21.60	14.40	14.40
Total	19520.23	5254.24	1581.33	1555.53	1481.30	1677.61	1616.04
Emissions limits[3]	80,000	200,000	80,000	50,000	30,000	*******	80,000

1. Total time for dredging and disposal of eleven days,and equipment operating 24-hr/day.
2. Total operating time for site renovation (45 dys, 8 hrs/dy).
3. North Coast Unified AQMD significant annual emissions rates by air contaminant (lb/yr).

Dust and Odors from Dredged Sediments Placed Upland

Fugitive dust emissions in the form of PM_{10} would be generated during any site preparation and levee construction if soil conditions were dry. Transportation and disposal of the dredged material would not produce appreciable fugitive dust because the material will be wet until removed from the upland site. No large areas of bare, dry soil would be exposed during drying operations.

Odors could be emitted from the dredged materials from the decay of organic matter. The prevailing wind across the disposal site is such that the only nearby receptors, several small businesses along Sunset Circle and the Holiday Inn on Highway 101 could potentially be affected by nuisance odors from the drying yard. With the high volume of marine airflow which normally occurs in coastal Del Norte County, nuisance odors are expected to occur rarely, most likely during infrequent periods of air stagnation which are most common in late summer, fall and early winter.

Mitigation Measures

Dredging and disposal activities would exceed the local air pollution control district criteria for significance only for the peak 24-hr emissions for NO_X. The Corps of Engineers will incorporate the following mitigation measures that might reduce project emissions. One feasible method for reducing NO_X emissions is to retard fuel injection timing on diesel-powered equipment. Retarding the injection timing by two degrees on each engine reduces NO_X emissions by about 15%.

The use of reformulated fuel would reduce NO_X and PM_{10} by approximately 7 and 15% respectively. An added advantage is that use of reformulated fuel would also reduce SO_2 emissions by about 90%. Even with the mitigations outlined above, the peak 24-hr project emissions for NO_X would still remain considerably above the threshold for significance established by the NCUAQMD.

Retarding injection timing by two additional degrees would further reduce NO_X emissions, but this was not considered feasible because of fuel economy penalties. Electrification of diesel-powered dredges would nearly eliminate emissions, but is infeasible for this project. Phasing of dredging activities so as to spread project emissions over a longer period of time was considered impractical for a deepening project of this size.

Additional mitigation measures that will be implemented to further reduce project emissions include:

1. Avoid idling haul trucks and other construction equipment as much as practicable.

2. Keep all engines and equipment maintained and in proper running order.

3. Reduce NO_x emissions further by using an inter-cooler on a turbo-charged diesel engine on the dredger. An inter-cooler could be installed to reduce the air temperature to the engine intake, thereby reducing the NO_x emissions by approximately 10%.

4. Adhere to mandatory requirements of NCUAQMD Rule 410 (No permit is required).

5. Confine project operations to the early summer season when marine airflow is strongest and air stagnation is least likely.

6. If any local residents or building occupants complain of dust or odor nuisances during either disposal site renovation or dredging operations, the Corps resident engineer will immediately report such complaints to the NCUAQMD, who will investigate the complaint and require adjustments in project operations to alleviate the condition.

Long-term Air Quality Impacts

The deepening and expansion of the Crescent City Harbor Access Channel is not expected to increase the number or change the kinds of vessels using the harbor, nor is it expected to attract new industry or other air pollution sources into the harbor area. . Completion of the project will reduce delays that some deeper draft vessels currently experience at low tide. Inasmuch as the deepening project is not expected to bring about any appreciable increase in harbor traffic, or induce growth that could cause secondary traffic or pollution in the area, the preferred project alternative would have no long-term air quality impacts.

Summary

The proposed disposal site renovation and the dredging operations would each individually result in 24-hr peak emissions which would exceed the NCUAQMD threshold for significance for NO_x. The main sources of NO_x would be the hydraulic dredge, dozers, a survey boat and a tugboat. These temporary emissions would last only for the 45 days for the disposal site re-construction and for an additional eleven days for dredging operations. Neither worst-case emissions scenario for peak 24-hr emissions is likely to occur during project operations. It is unlikely that the proposed project would bring about a violation of the state ambient air quality standard for nitrogen dioxide or for the state or federal ozone standard. Ambient air quality levels would quickly return back to the pre-project levels in the harbor area and would not be expected to have adverse health effects on any receptors. The proposed disposal site renovation and dredging activity would therefore not likely have a significant long-term or short-term impact on air quality.

References

North Coast Unified Air Quality Management District. *Regulation 1, Air Quality Control Rules of the California North Coast Air Basin*. Dec 1997.

U.S. Environmental Protection Agency. *AP-42, Compilation of Air Pollutant Emission Factors, Vol I and II, Stationary Sources.* 1985, w/amendments.

Agencies, Organizations, and Persons Contacted

Marks, Lindsay, Harbor Master, Crescent City Harbor District, telephone conversation 28 Jan 1998.
Torzynski, Robert, Air Quality Planner, North Coast Unified Air Quality Management District, telephone conversation, 10 Dec 1997.

3.5 Fish and Wildlife

Benthic Community

The benthic invertebrate community is generally separated into infauna, those animals that live within the sediment, and epifauna, those animals associated with the surface of the sea floor. The distribution and abundance of benthic infauna in nearshore continental shelf sediments is related to sediment grain size (9), organic content of sediments, interactions among organisms, and environmental disturbances. These factors determine the species composition of an area. Predominantly sandy sediments, such as those in the access channel, tend to support a lower invertebrate species diversity than do finer sediments. The existing access channel is frequently disturbed by prop-wash from larger fishing vessels and by the Harbor District's attempts to maintain the channel, resulting in a benthic community adapted to frequent disturbance. Therefore, the existing community is likely to be unstable, less developed, and less productive than undredged areas.

Impacts to the benthic community existing in the proposed channel area would be direct, consisting primarily of its removal. However, because the community present at the access channel consists of opportunistic species or those tolerant of disturbance, recolonization of a similar community would occur in a relatively short time period. Original biomass is sometimes reached in two weeks to four months. In areas that had not been disturbed previously (i.e. widened slopes), the benthic community would be recolonized by a less developed community similar to the existing channel assemblage. There is very little undisturbed benthic habitat in the vicinity of the access channel. Therefore, the overall benthic community found within the harbor would not be significantly altered by the navigation improvements.

The most commercially important epifaunal invertebrate inhabiting the harbor area is the Dungeness crab, *Cancer magister*, which sustains a lucrative fishery along the northern California and Oregon coasts. Adult crabs are found living over several substrate types, but they prefer sandy-mud bottoms (12). Dungeness crabs are highly mobile and change depths in response to local conditions such as storm surge. These crabs also move into shallower water at night and deeper water during daylight in response to food availability.

Adult Dungeness crabs concentrate in shallow sandy areas to mate between March and July. During September and November the egg brooding females partially bury themselves in shallow subtidal and intertidal sands until their eggs hatch. The first life history stages of young crabs are planktonic. The larvae settle out as juveniles, which remain in shallow inshore areas for 11 to 15 months before moving offshore.

While Dungeness crabs are quite mobile, it is possible that some mortality would occur during dredging operations. Due to the small footprint of the project, mortality would be insignificant. The crabs would avoid any local negative water quality effects. The project would also be scheduled to avoid the mating season, when crabs concentrate in the shallows, further minimizing any effects.

Fish

A variety of rockfish (*Sebastes spp.*) inhabit the harbor and presumably access channel area as well. Rockfish spawn in Crescent City Harbor in winter and early spring. The eggs are fertilized internally and larvae are released to the water column in the spring. Larvae are dispersed widely by ocean currents. Pacific herring enter Crescent City Harbor from December through February to spawn. Large quantities of demersal eggs are deposited and fertilized. Eelgrass is the substrate of preference, but females will attach eggs to a variety of surfaces such as pilings, rocks, and riprap. The eggs are deposited in masses that can be as many as eight layers deep. The eggs generally hatch within two weeks of the spawn. While juveniles and adults are capable of avoiding the affected area, egg development can be hindered by siltation and depressed dissolved oxygen levels resulting from dredging activities. Other species found in the harbor are steelhead, coho and chinook salmon, jacksmelt, and lingcod.

Dredging will be scheduled during late August to early November to avoid spawning activity and sensitive life history stages. Adult and juvenile fish are expected to avoid the immediate dredging area. Therefore, the proposed project would have no significant effect on the fish population of Crescent City Harbor.

Wildlife

The harbor seal and California sea lion frequent Crescent City Harbor. The harbor seal is an active predator in the harbor, feeding primarily on fish, but taking invertebrates as well. The California sea lion may be found on offshore rocks, secluded beaches, in the harbor, and on buoys. A wide variety of shorebirds and migratory waterfowl inhabit the harbor on a seasonal basis. These animals would avoid the immediate area of dredging and its effects. As the footprint of the project is relatively small, there would be no significant effect on the food source for local wildlife.

3.6 Endangered/Threatened Species

The United States Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) are federal agencies (part of the Departments of the Interior and Commerce, respectively) that have the responsibility for implementing the Endangered Species Act, influencing decisions on proposals which have the potential to impact fish and wildlife habitat. Coordination with FWS and NMFS is ongoing to research the possible existence of endangered, threatened, and candidate species protected under the Endangered Species Act which would be impacted by the proposed project. Recommendations from both Services and the State have been taken into consideration and incorporated into this EA.

FWS and NMFS have identified any listed, proposed, and candidate threatened and endangered species that may occur in the vicinity of the proposed action (Appendix B).

Listed Species

American Peregrine Falcon *Falco peregrinus anatum*. This species is listed as endangered by the Federal Government. It is very widely distributed and occurs in a variety of habitats. Outside of cities, this species generally nests on cliffs. This falcon feeds on other birds that it captures in mid-air. It is listed as endangered due to severe population losses in recent decades caused largely by organochlorine pesticide residues. Other factors such as human disturbance of nesting areas, shooting, and loss of chicks to falconers have also had a significant negative impact (18).

The proposed action would not impact the peregrine falcon or its habitat, as it would have no effect on populations of prey species or on the availability or suitability of hunting and nesting habitats. This species is extremely vulnerable to disturbance during the nesting season, and may abandon its nest due to such disturbance. However, there is no suitable nesting habitat within at least two miles of the project and the construction will be conducted in the fall, outside of the peregrine's spring nesting period.

Marbled Murrelet *Brachyramphus marmoratus*. This species is listed as threatened by the Federal Government. It is found in coastal areas from the Aleutian Islands to central California. Loss and modification of nesting habitat from commercial timber harvesting appears to be the primary cause of the decline of this species. Successful nesting requires at least a 60-acre stand of old growth forest or a sizable stand of mature trees with a sufficient component of old growth trees. Essentially a coastal species, marbled murrelets spend most of their time resting on the water close to shore. Because murrelets feed on fish and invertebrates near shore, gill net mortality from commercial fishing has also contributed to their decline. Adult birds mature early at two years, but mated pairs only produce one chick per year, resulting in low and irregular reproductive rates (34).

This species probably occurs sporadically in the vicinity of the project site on a transitory basis. However, there is no suitable nesting habitat for this species in the vicinity of the site due to the absence of mature and old growth forests. The proposed action would have no effect on this species.

Bald Eagle *Haliaeetus leucocephalus*. This species is currently listed as threatened in most parts of the contiguous United States, after having been previously listed as endangered. Historically, it occurred over most of California, but excessive mortality and habitat loss greatly reduced both its abundance and range within the state. Recently the FWS has determined that the bald eagle has recovered and they have proposed its removal from the Endangered Species list. Large old trees with dead tops are used for roosting and nesting by the bald eagle. Rivers and lakes are preferred foraging habitat for this species, which eats primarily fish, and to a lesser extent waterfowl and carrion. Disturbance of nesting areas may cause nests to be abandoned (18).

The bald eagle may occur in the vicinity of the proposed action. This species is not expected to occur at or near the site during construction except perhaps as an occasional transient. No impact on this species is expected.

Aleutian Canada Goose *Branta canadensis leucopareia*. This subspecies is listed as threatened by the Federal government. Today the only known breeding populations occur on Buldir and Chagulak islands in the Aleutians. The pasture land just north of Crescent City and Castle Rock are used by the geese during fall and spring migrations to and from their wintering grounds in the Central Valley. As these geese do not use the immediate project area, the proposed action would have no effect on them.

Northern Spotted Owl *Strix occidentalis caurina*. The northern spotted owl has been listed as threatened by the Federal Government due to extensive habitat loss caused by logging of old-growth forests. Forest management activities are considered to threaten the long-term viability of this species in the state. This owl generally inhabits old-growth conifer forests, or sometimes younger forests that exhibit certain old-growth characteristics. Large individual trees, large snags, and multiple canopy layers are important habitat attributes for this species. It is thought that a more open forest structure allows excessive predation by larger raptors. This species feeds primarily on forest rodents.

There is no suitable nesting or foraging habitat for this species in the vicinity of the site due to the absence of mature and old-growth forest stands. The proposed action would have no effect on this species.

Western Snowy Plover *Charadrius alexandrinus nivosus*. The coastal population of the western snowy plover is listed by the federal government as threatened. These birds breed primarily on coastal beaches from southern Washington to Baja California. Snowy plovers lay their eggs in in a shallow depression in the sand, sometimes lined with small pebbles, glass fragments, or gravel. Nesting occurs from April through August. The plover's numbers have declined due to human activity on beaches during the nesting season. Jogging, off-road vehicles, pets, and horseback riding either destroy the nests outright or cause adults to abandon incubating eggs.

The beach area near the proposed project is frequented by runners, vehicles, and dogs, making it unlikely that snowy plovers would nest there. In addition, this project would occur outside of the nesting season. Therefore, the proposed action will have no effect on the population.

Tidewater Goby *Eucyclogobius newberryi*. The tidewater goby is federally listed as endangered. This benthic species inhabits shallow lagoons and the lower reaches of coastal streams where salinities range from fresh water to 10 parts per thousand. The diet of this goby consists of small crustaceans, aquatic insects, and mollusks. Water depth in tidewater goby habitat ranges from 25 to 100 centimeters. The substrate usually consists of sand and mud, with abundant submerged and emergent vegetation. Elk Creek is the only fresh water outlet into Crescent City Harbor. At best this creek would be marginal habitat for the goby as the lower reach of the creek is in a residential/business area. The mouth of Elk Creek lies 0.5 miles from the proposed project; away from the effects of dredging and disposal activities. Therefore, the proposed project would not impact the tidewater goby.

Coho Salmon *Oncorhynchus kisutch*. The Southern Oregon/Northern California Coast Evolutionary significant Unit (ESU) was listed as threatened in May of 1997.

Adult coho salmon in northern California and southern Oregon typically begin their freshwater spawning migration in September or October, spawn in December, then die. Juveniles rear in fresh water for up to 15 months, then migrate to the ocean as smolts in the spring. Coho typically spend two growing seasons at sea before returning to their natal stream to spawn as three-year-olds.

The proposed project would occur in a Late August to early November time frame that would prevent any potential effects to outmigrating juvenile fish. Any adult fish migrating to Elk Creek would most likely avoid the project site. Therefore, there would be no impact to the Coho population in the harbor.

Oregon Silverspot Butterfly *Speyeria zerene hippolyta*. The Oregon silverspot butterfly is federally listed as threatened. Occurring along the coast in northern California and Oregon, this butterfly requires a meadow species of violet (*Viola adunca*) to complete its development. Both the silverspot and its host violet are members of disturbance-oriented meadow communities. Since there are no such meadow areas in the vicinity of the proposed project site, there would be no impact to the Oregon silverspot butterfly or its host plant.

Western Lily *Lilium occidentale*. The western lily is federally listed as endangered. This lily is a hydrophytic species found in sphagnum bogs, forests, and around the margins of ephemeral ponds. It is also found in coastal prairies and coastal scrub where fog is common. The western lily has been found in the wetland area across highway 101 from the disposal site. It is possible that the disposal site and adjacent lot to the north could harbor the western lily. On a previous site visit in 1996, no lilies were found. The disposal site would be surveyed prior to the onset of the project to determine if the lily were present. If so, FWS would be notified, and appropriate measures would be jointly developed. The proposed project is not expected to impact the western lily.

Candidate Species

Klamath Mountains Province Steelhead *Oncorhynchus mykiss.* This salmonid was proposed for threatened status until March of 1998 when NMFS determined that this ESU did not warrant listing at that time. This ESU is now classified as a candidate species due to continuing concern for the status of the species in the area.

There are essentially two types of steelhead runs. Summer run steelhead enter fresh water between May and October, beginning their spawning migration in a sexually immature state. After several months in fresh water, summer steelhead mature and spawn. Winter run fish remain at sea until sexually mature and enter fresh water between November and April. Spawning of both runs occurs between December and June. Juveniles rear in fresh water from one to four years (typically two years), and then migrate to the ocean, where they spend two to three years before returning to their natal stream as four to five year olds.

The proposed project would occur in a Late August to early November time frame that would prevent any potential effects to outmigrating juvenile fish. Few adult fish would be in the harbor at the time period, as it would occur between summer and winter runs. Any stragglers would most likely avoid the project site. Therefore, there would be no impact to the steelhead population in the harbor.

Wolf's Evening-Primrose *Oenothera wolfii*.

This species is a biennial with a basal rosette and a flowering stem up to three feet tall. Wolf's evening primrose primarily inhabits sandy areas in coastal scrub and coastal prairie, as well as coastal sand dunes. It also is occasionally found in open areas along roadsides. A few individuals were identified in 1996 along both sides of Anchor road where it intersects U.S. 101 and in the lot immediately to the north. However, no specimens of Wolf's evening primrose were found at the disposal site during habitat evaluation. The disposal site would be surveyed prior to the onset of the project to determine if any Wolf's evening primrose were present. If so, FWS would be notified, and appropriate measures would be jointly developed. It is unlikely that this plant would be affected by the proposed project.

Species Of Concern

The list provided by FWS also named a number of species of concern. These are species for which existing information may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

The white footed vole *Arborimus albipes*, California red tree vole *Arborimus pomo*, Pacific fisher *Martes pennanti pacifica*, and Northern Goshawk *Accipiter gentilis* are all inhabitants of mature conifer forests with well developed canopy closure and with plentiful snags and downed logs. As there is no such habitat in the area, these species would not be affected by the proposed project.

The little willow flycatcher *Empidonax traillii brewsteri* is a migratory species that is a summer resident in wet meadow and montane riparian habitat above 2000 feet in elevation. The proposed project would not begin until late August, after these birds would have left for their wintering grounds.

Five species of myotis bat and the Pacific western big-eared bat *Plecotus townsendii townsendii* may also be in the area. These bats roost in caves, mines, abandoned buildings, hollow trees, under bark, and in crevices. There are no suitable roosts in the immediate area of the proposed project. Some of these bats may forage for insects in the area, but are unlikely to be affected by operations. Therefore the proposed project would have no impact on bat species.

Salinity in the harbor and at the disposal site is too high to support any populations of amphibians, so none will be impacted by the project.

The northwestern pond turtle *Clemmys marmorata marmorata* occurs in the northwestern portion of California in areas west of the Sierra-Cascade crest, and northward to British Columbia. It is associated with permanent and nearly permanent bodies of water at low and moderate elevations. It requires basking sites in or adjacent to its aquatic habitat. Egg laying occurs either in sandy banks along the stream, or farther from the stream where suitable soil is available (17). There is no habitat suitable for this turtle in the project area and there would be no impact to the species.

Fish species of concern such as the green sturgeon *Acipenser medirostris* and the Pacific Lamprey *Lampetra tridentata* are highly mobile and would likely avoid the area being dredged.

The upland disposal site is currently used by the Crescent City Harbor district on a regular basis and vegetation cover is minimal. During a site visit in 1996, no sensitive plant species were identified within the site. If the site were to be unused for an extended period of time, some of these plants could establish themselves in the site. A sensitive plant survey would be conducted if such an inactive period were to occur before the proposed project.

It is unlikely that any of the indicated sensitive invertebrate species are present at the disposal site as disposal operations occur frequently.

In conclusion, this project is expected to have no effect on endangered, threatened, and species of concern in Crescent City Harbor. Avoidance and limited use of the dredging areas by such species during dredging operations will render negligible any short-term effects associated with turbidity, food reduction, or toxicity. Long term effects, such as reduction in benthic based food resources, are also expected to be negligible due to the fairly rapid recovery expected.

Endangered species consultation with NMFS and FWS pursuant to Section 7 of the ESA has been completed. Correspondence with these agencies is provided in Appendix B. FWS concurred with the findings of this BA in a letter dated July 15, 1999. NMFS concurred in a phone conversation in August of 1998.

3.7 Cultural Resources

Cultural resources represent the remains of previous human activity that can be either archaeological (artifacts found on or within the ground) or historical (standing architectural features, structures, or natural landmarks, used over time) including buildings, bridges, shipwrecks and other maritime features. Evaluation and treatment of cultural resources potentially affected by the proposed project are mandated under federal and state statutes including Section 106 of the National Historic Preservation Act, Heritage Conservation and Recreation Service Executive Order 11593, the Advisory Council on Historic Preservation Regulations (36 CFR Part 800); and California Environmental Quality Act (CEQA) Appendix G (Significant Effects) and Appendix K (Archaeological Resources).

Federal and state criteria are used for evaluating the significance of cultural resources. The federal criteria for defining cultural resource significance for National Register of Historic Places eligibility are established by the National Park Service (36 CFR 60.4). These criteria pertain to projects undertaken by any federal agency with federal funding and/or jurisdiction. According to the National Register criteria, a significant cultural resource has *integrity* and contains one of the following qualities:

A. Is associated with events that have made a significant contribution to the broad patterns of history; or

B. Is associated with the lives of persons significant in the past; or

C. Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or

D. Has yielded, or may be likely to yield, information important in prehistory or history.

CEQA Appendix K (Archaeological Resources) states that an important, or significant, archaeological resources is one that:

A. Is associated with an event or person of:

1. Recognized significance in California or American history; or

2. Recognized scientific importance in prehistory.

B. Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable or archaeological research questions;

C. Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind.

Project Description and Area of Potential Effects

The Corps is required to define the Area of Potential Effects (APE). The APE is often defined as the geographic areas of an undertaking where changes to historic properties may occur, if such properties are present. The APE of Crescent City project is the (shallow-depth) Access Channel that connects the Small Boat Basin and Citizens Dock to the federal Inner Harbor Channel. The Corps would dredge and maintain the Access Channel for approximately 1,000 feet (distance between the existing Federal channel and the entrance to the Small Boat Basin) with a width of 140 feet, which flares to 210 feet at the Inner Harbor Channel junction and 180 feet at a bend

near the Small Boat Basin entrance.

Also included in the APE is the Harbor District's upland dredged-material disposal site. In the past the disposal site was surveyed by a qualified archaeologist to determine if cultural resources were present. No cultural resources were identified. All sediments and any rock removed from the Access Channel will be hauled by truck, over developed roadway, to the upland dredged-material disposal site.

Findings and Impacts

No physical structures, archaeological or historic sites have been recorded within the project's APE, which includes the Harbor District's upland disposal site, based on a search of maps and records at the Northwest Information Center. A review of the National Register of Historic Places, the California Inventory of Historic Resources, California Historical Landmarks, and the State Lands Commission Data Base for submerged resources revealed no significant resources in the APE.

Since no historic properties eligible for the National Register have been identified within the APE, dredging and disposal of materials at the Harbor District's upland disposal site would have no effect on significant cultural resources. In addition, the effects of the repeated dredging activities, as well as previous navigation improvements, make the potential for finding submerged resources very low.

Based on the history of repeated dredging activities and previous navigation improvements, the Corps of Engineers has determined that additional cultural resources investigation is not warranted at this time. However, it is possible that cultural resources may exist within the APE as submerged or buried sites. If project construction reveals material evidence of past human cultural activity (e.g. carved wood, stone tools, metal coins or anchor, human bone, etc.) work within the vicinity of the find should immediately cease until a qualified archaeologist can be consulted and appropriate evaluation made and recommended actions taken.

3.8 Commercial/Recreational Fisheries

As of 1993, the harbor contained a 308 berth commercial small boat basin, a 527 slip recreational moorage facility, two fish processing plants and docks, a main dock (Citizen's Dock), an unused dilapidated oil terminal, a marine repair facility and synchrolift, a Coast Guard dock, and other auxiliary commercial and recreational facilities.

Commercial and recreational fishing activities comprise the majority of vessel traffic in Crescent City Harbor. Commercial activity accounted for about 90 percent of the total commerce and is expected to continue to be of great importance. The commercial fishing fleet permanently based in the harbor consists of approximately 246 boats, averaging 43 feet in length, with drafts ranging from 2 to 14 feet. During storm periods, the harbor is used as a "harbor of refuge" by

boats from both the California and Oregon fishing fleets.

Fish and shellfish landings at Crescent City Harbor have historically ranged between 1.5 million to over 36 million pounds annually. Most of the fishing effort is done by trawling, the most common species landed being whiting, shrimp, crab, rockfish, Dover Sole, thornyheads, and sablefish. In 1988, over 36 million pounds of fish and shellfish were landed, with a market value of 11.9 million dollars. Whiting and other bottom fish comprised the majority of the catch at 20,283,000 pounds. Other major species landings for 1988 were shrimp (10,251,749 lbs.), crab (5,234,181 lbs.), salmon (178,000 lbs.), and albacore (120,000 lbs.).

Trawling is not permitted within the three-mile limit, so efforts within this zone consist mainly of trolling for salmon and crabbing with traps. These efforts amounted to approximately 38 angler days per boat per year. A limited, yet valuable, herring roe harvest also exists, with 30 tons a year being taken by 3 fishermen.

Sport fishing activities take place predominantly in the summer months within the three-mile limit. Salmon is the most prized catch and amounts to approximately 100 angler days each for some 600 boats. Offshore sport fishing for silver and chinook salmon occurs in a 44 square mile band off Crescent City. Rockfish, lingcod, kelp greenling, cabezon, and Pacific halibut are also taken by sport fishermen along Chase Ledge and south of Crescent City.

Small numbers of clams are harvested recreationally from South Beach. Harvest volumes are insignificant compared to the region's recreational clam take. Major species sought include gapers, basket cockles and littleneck clams on the beach areas, but efforts are limited.

Maintenance of the overall productivity of coastal waters is essential to sustain fisheries, therefore significant habitats such as feeding or nursery grounds require particular attention.

Although important species occasionally use the dredge site such as; Dungeness crab, herring, lingcod, jack mackerel, rockfish, cabezon, steelhead, and coho salmon, the commercial/recreational fishing industries are not active in these areas during the September through November proposed project time frame. Therefore, there would be minimal impact to the fisheries. (41)(42)(48).

4.0 CONSISTENCY DETERMINATION AND REQUIRED PERMITS

4.1 Consistency Determination with the Local Coastal Plan

Authority

This Coastal Consistency Determination is submitted pursuant to Federal Consistency With Approved Coastal Management Programs regulations found at 15 CFR 930 requiring Federal agencies to provide state coastal zone management with a consistency determination for any activity directly affecting the coastal zone.

Determination

The U.S. Army Corps of Engineers, San Francisco District, has prepared this consistency determination pursuant to Section 307 of the Federal Coastal Zone Management Act of 1972, as amended (16 USCA §1451). This Act requires Federal agencies to conduct activities directly affecting the designated coastal zone in a manner consistent with approved state management programs to the maximum extent practicable. The Federal navigation project for the Crescent City Harbor Access Channel is sited in the California coastal zone and will directly effect coastal zone resources.

The U.S. Army Corps of Engineers, San Francisco District has evaluated the project relative to the California Coastal Act of 1972, as amended, and has found it to be consistent to the maximum extent practicable with the applicable provisions of Chapter 3, Coastal Resource Planning and Management policies for the reasons stated below.

Project Description

Project alternatives, site plans, and cross sections, are discussed in detail in the General Re-evaluation Report (GRR) and the Environmental Assessment (EA) and are incorporated herein by reference. The project plan for harbor improvement is to dredge and maintain an access channel from the existing Federal channel to the entrance of the Small Boat Basin. The proposed action includes disposal to an adjacent upland disposal site owned and operated by the Crescent City Harbor District. The material will be transported by either truck or pipeline. The alignment of the pipeline and the truck haul road from Citizen's Dock Road to the disposal site are located on Plate 2 of the GRR.

The proposed project's consistency with each applicable Coastal Zone Management Act policy/provision from the Del Norte County, City of Crescent City and the Crescent City Harbor LCPs are analyzed below:

* *Coastal Act Provision 30211- Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

The proposed project will not result in encroachment upon public's rights of access to the sea where acquired through use or legislative authority. During construction, there may be temporary public access issues for safety reasons related to specific equipment staging areas, pipeline installation and truck loading areas when used for disposal to the upland disposal site.

* *Coastal Act Provision 30230- Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Marine resources shall be maintained by keeping the access channel to the Federal Channel unobstructed so that water related recreation, navigation and commerce may continue.

* *Coastal Act Provision 30233(a)- The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible, less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:*

(2) Maintaining existing, or restoring previously dredged, depths in existing navigational channels, turning basins, vessel berthing and mooring areas, and boat launching ramps.

Project dredging and maintenance will occur between late August to early November to the extent feasible to best minimize impacts on critical life stages of coho salmon and Klamath Mts. Province steelhead. The proposed action has been evaluated and determined to be the least environmentally damaging alternative.

* *Coastal Act Provision 30233(b)- Dredging and spoils disposal shall be planned and carried out to avoid significant destruction to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be transported for such purposes to appropriate beaches or into suitable longshore current systems.*

The proposed project has the least impact to the marine habitats and beaches. Removal of this

material from the coastal waters will result in a minimal impact to the longshore current system. Short-term increases in turbidity are expected in the channel during channel construction and maintenance and during disposal of maintenance dredged material at the ocean disposal site, but will be limited to late August to early November.

* *Coastal Act Provision 30240- (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas. (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.*

The proposed project avoids environmentally sensitive habitat areas. Damage to adjacent habitat during construction and disposal operations have been minimized by transportation of the dredged material to an existing upland disposal site through a pipeline and trucking over existing roadways.

* *VII SPECIFIC AREA POLICIES AND RECOMMENDATIONS:*
B. Intertidal Zone Policy (4)(a)- Tidepools and tidal flats shall be managed to maintain their present characteristics with all feasible measures taken to mitigate uses which might prove harmful to the biota inhabiting these areas.

Impacts to these areas will be avoided during construction and disposal by taking the dredge material to the Harbor District's Upland Disposal Site via pipeline and trucking over existing roadways. The Contractor's staging area is located immediately adjacent to Citizen's Dock, on a pavement.

* *VII SPECIFIC AREA POLICIES AND RECOMMENDATIONS:*
D. Wetlands Policy (4)(b)- Dredging and spoils disposal shall be planned and carried out to avoid significant disruption to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment when feasible should be transported for such purposes to appropriate beaches or into suitable longshore current systems.

Disruption to these resources will be avoided by disposing the dredged material to the Harbor District's Upland Disposal Site. Beach replenishment has been discussed, and was preferred by the Coastal Commission as stated in their letter dated September 20, 1993. Further consideration has determined that deposition of this material could hinder developing wildlife communities that have emerged since the most recent beach disposal operations. Disposal into the longshore current system is not favored due to fluctuations of seasonal current patterns and uncertainties concerning the ultimate location of disposition. Disposal at Whaler Island was considered, but

eliminated as an option due to levels of organic content in the sediment that are unacceptable for beach nourishment.

This consistency determination was submitted to the Coastal Commission with a request for concurrence on July 1,1998. The Coastal Commission at their September 10, 1998 public hearing considered the matter. The Commission concurred with the Corps consistency determination, finding that the project is consistent to the maximum extent possible with the California Coastal Management Program. The consistency determination was adopted as CD-81-98 (See Appendix C).

4.2 Clean Water Act Requirements

On July 1, 1998 the Corps requested water quality certification or waiver pursuant to Section 401 of the Clean Water Act in a letter to the North Coast RWQCB. The board responded in a letter on September 15, 1998, which stated that water quality certification is not required as the actions of this project are regulated under the existing Order No. 92-103 (See Appendix C).

4.3 Marine Protection, Research, and Sanctuaries Act of 1972

Ocean disposal of dredged material is regulated by the EPA and the Corps of Engineers under the MPRSA. Provisions of this Act require that the Secretary of the Army make determinations for the transportation of dredged material for the purpose of dumping it into ocean waters. The Act's primary purpose is to regulate the dumping and transportation for dumping of waste materials in parts of the ocean, so that no unreasonable degradation or endangerment shall occur to human health, welfare or amenities of the marine environment, ecological system, or economic potentialities.

The maintenance dredged material from this proposed expansion/deepening project must be deemed environmentally acceptable for ocean dumping at the EPA interim designated disposal site based upon the chemical and bioassay results and conditions set forth in Section 102 evaluation requirements. SF-1 has been used as a temporary disposal site for Crescent City Harbor dredged material disposal since the 1970's under the authority of Section 103 of the MPRSA.

The MPRSA mandates that the EPA and the Corps develop "site management plans" for its designated interim ocean disposal sites. After January 1, 1995, no site shall receive a final designation unless a management plan has been developed pursuant to the MPRSA. As of January 1, 1997, no permit for dumping pursuant to the MPRSA or authorization for dumping under Section 103(e) of the act shall be issued for a site unless such site has received a final designation. The Corps plans to pursue permanent designation of the site under Section 102 of the act. This would require the preparation of an EIS and a site implementation and management plan.

The maintenance dredged material's acceptability for ocean dumping will be based on the bioassay test results and requirements of Section 102 of the MPRSA.

Also, there must be no conflict with the use of SF-1 in relation to:

1. Navigation and fishing efforts by local sport and commercial fisherman (See Section 3.7 Commercial/Recreational Fisheries);

2. The consistency determination by the California Coastal Commission under Section 307(c) of the Coastal Zone Management Act (CZMA) (See Section 4.1 Consistency Determination with the Local Coastal Plan);

3. The State water quality certification by the RWQCB, North Coast Region under Section 401 of the Clean Water Act (See Section 4.2 Clean Water Act Requirements); or

4. State and Federal resource agencies including the California Department of Fish and Game (CDFG), FWS and NMFS.

The proposed disposal of maintenance material at SF-1 will need to be reviewed for compliance with the requirements of the EPA's Ocean Dumping Regulations at 40 CFR 220 to 225 and 227 to 228 promulgated pursuant to Sections 102(c) and 108 of the MPRSA. The Corps will need to determine that the project will not have unacceptable adverse effects on human health or the marine environment as defined at 40 CFR 227.4, and will request the EPA's concurrence with this determination.

A Notice of Discharge of Dredged Material, Crescent City Harbor Maintenance Dredging, Del Norte County, California was issued by the COE on June 24, 1988. This notice remains in effect indefinitely unless there is a change in the disposal plan, pursuant to Section 103 of the MPRSA and Section 401 of the Clean Water Act (CWA). As this proposal does constitute a change in the disposal plan since the last dredging episode, another public notice will need to be circulated in order to advise interested parties and to solicit their comments for the purpose of evaluating the suitability for the discharge of dredged material into the waters of the United States.

5.0 MITIGATION MEASURES

In accordance with paragraph 7-35 of ER 1105-2-100, *Guidance For Conducting Civil Works Planning Studies*, the planning of Corps projects shall ensure that project caused adverse impacts to fish and wildlife resources have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. The recommended plan shall contain sufficient mitigation to ensure the plan selected will not have more than negligible net (including mitigation) adverse impacts on fish and wildlife resources.

The Coordination Act Report prepared by the FWS does not recommend any mitigation for impacts of channel construction due to the small area affected by the project (See Appendix D). No mitigation is recommended for use of the ocean disposal site (SF-1) providing the material dredged from the access channel meets EPA greenbook standards for ocean disposal. The FWS is withholding any mitigation recommendations for the upland disposal alternative pending verification that permitting of the site will be renewed promptly. If the permitting is renewed without delay, there will be no additional impact. However, if permitting is delayed, and habitat is allowed to develop at the disposal site, it is likely that the FWS will recommend mitigation for the habitat that would develop at a ratio between 1:1 and 2:1.

The FWS recommends in the CAR that project dredging be restricted to a late August to early November time frame to the extent feasible, to best minimize impacts on critical life stages of coho salmon and Klamath Mts. Province steelhead, which use the Crescent City Harbor. Maintenance dredging should be restricted to this same window as well. In addition, the FWS recommends that the upland disposal site be surveyed to determine the presence of the western lily. The disposal site will also be surveyed for Wolf's evening primrose. The Corps would follow these recommendations and would develop appropriate safeguards if necessary in coordination with CDFG and FWS.

6.0 COORDINATION

The Corps coordinated with the following entities in the preparation of this document: the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Game, California Coastal Commission, California State Lands Commission, North Coast Regional Water Quality Control Board, State Historic Preservation Officer, U.S. Coast Guard, Crescent City Harbor District, the County of Del Norte, the Del Norte Solid Waste Management Authority, the City of Crescent City, interested individuals, commercial fisherman via the CCHD and the public. A fifteen-day public notice will be circulated via a Notice of Discharge prior to the District Engineer's final decision on this matter.

7.0 CONCLUSION

Based upon the findings and proposed mitigation measures identified within in this EA, it is concluded that the recommended plan will have no significant effect on the quality of the human environment and no effect on threatened and endangered species protected under the Endangered Species Act, and an Environmental Impact Statement (EIS) will not need to be prepared.

8.0 INFORMATION SOURCES

8.1 References

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3. California Department of Fish and Game. 1990. *California's Wildlife, Vol. II, Birds*. Sacramento. 731 pp.

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5. *City of Crescent City Local Coastal Plan*, June 1982.

6. *Crescent City Harbor Local Coastal Plan, Port Land Use Plan*, September 1980.

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5.2 Agencies, Organizations and Persons Contacted

36. William Ehorn, Superintendent, Redwood National Park, personal interview 7/27/93.

37. Darren Fong, Fish and Wildlife Biologist, US Fish and Wildlife Service, telephone conversation on 8/10/93.

38. Bill Rodriguez, Environmental Specialist IV , North Coast Regional Water Quality Control Board. Telephone conversation on 8/24/93.

39. Bob Tasto, Senior Biologist, California Department of Fish and Game, Telephone conversation 8/18/93.

40. Joe Cordaro, Wildlife Biologist, US National Marine Fisheries Service, telephone conversation on 8/9/93.

41. Mike Thalbault, Fisheries Biologist, U.S. National Marine Fisheries Service, Telephone conversation 8/9/93.

42. Joe Dusenbury, Harbor Master, Crescent City Harbor District, Telephone conversation 8/9/93.

43. Diane Mutchie, Senior Planner, County of Del Norte Community Development Department, personal interview on 7/27/93.

44. Karl Brown, Assistant Director, County of Del Norte Public Works, meeting on 7/27/93.

45. Mark Delaplaine, Federal Consistency Supervisor, California Coastal Commission, telephone conversation on 7/12/93.

46. James Donovan, Lieutenant, U.S. Coast Guard, personal interview on 7/27/93.

47. Bob Hall, US Environmental Protection Agency, telephone conversation on 8/18/93.

48. Ron Warner, Associate Marine Biologist, California Department of Fish and Game, telephone conversation on 8/12/93.

49. Larry Graham, Project Manager, US Army Corps of Engineers, personal interview 8/23/93.

50. Kevin Hendrick, Director, Del Norte Solid Waste Management Authority, personal interview 12/6/94.

FINDING OF NO SIGNIFICANT IMPACT (FONSI)
ENVIRONMENTAL ASSESSMENT
CRESCENT CITY HARBOR CHANNEL EXTENSION AND DEEPENING
DEL NORTE COUNTY, CALIFORNIA
SEPTEMBER 1999

1. Proposed Action. To dredge an approximately 1,200-foot long access channel from the Federal Inner Harbor Channel to the entrance of the Small Boat Basin located at Crescent City Harbor, City of Crescent City, Del Norte, California. The channel bottom width would range from 140 feet to 210 feet where it would flare to meet the Inner Harbor Channel. The resulting 37,700 cubic yards of dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site. The capacity of this disposal site will be increased by raising the containment levee two to three feet.

2. References. Environmental Assessment for Crescent City Harbor Federal Channel Extension and Deepening General Reevaluation Report, Crescent City Harbor, Del Norte County, California, August 1999.

3. Factors Considered. Factors considered for this FONSI were impacts on water quality, fish and wildlife, endangered/threatened species and marine mammals, cultural resources, and commercial/recreational fisheries.

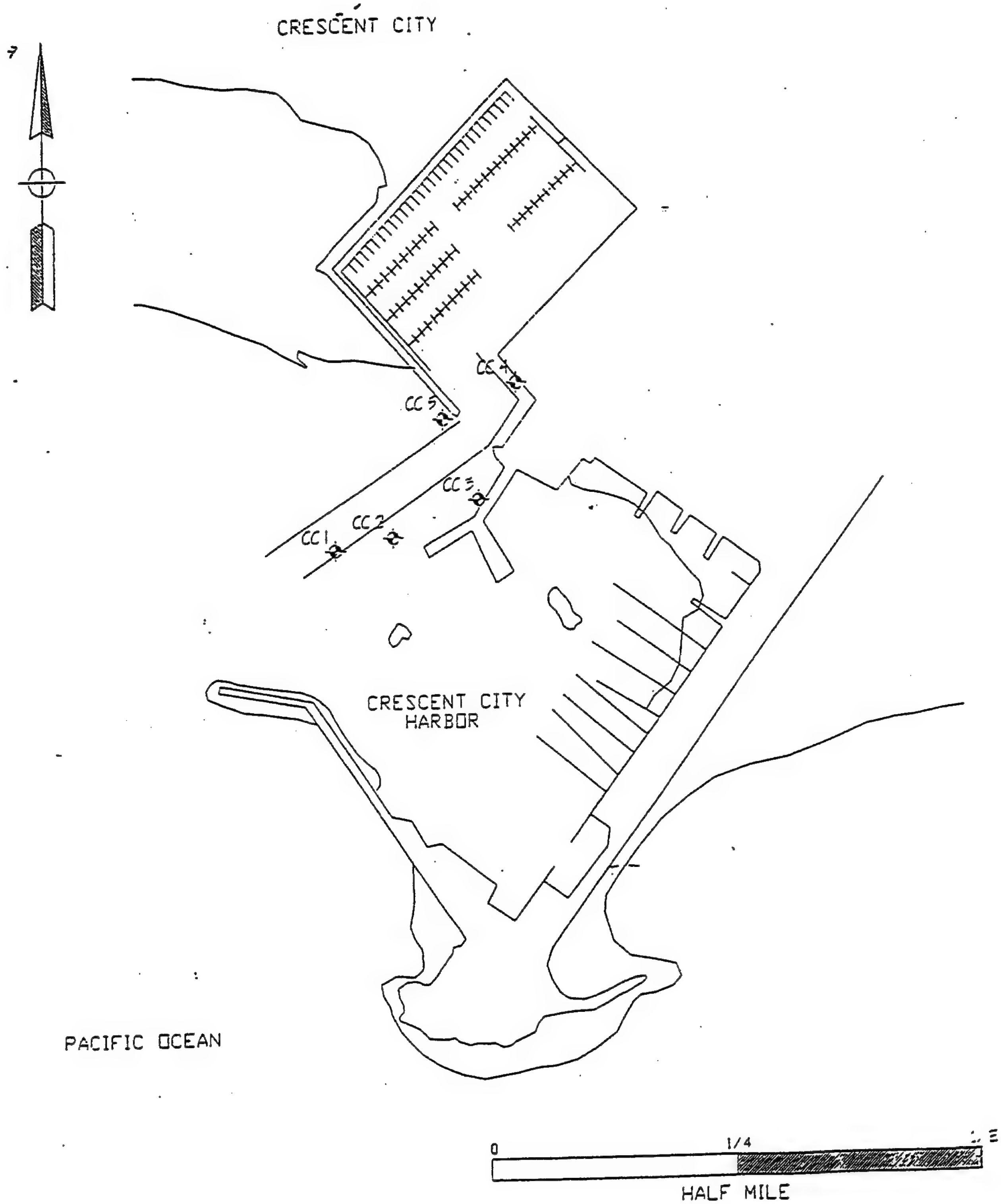
4. Conclusion. Based on the information obtained in the preparation of the Environmental Assessment, it is concluded that the proposed action will not have a significant impact on the quality of the human environment. Therefore, the preparation of an environmental impact statement is not required.

9.3.99
Date

Peter T. Grass
Lieutenant Colonel, Corps of Engineers
District Engineer

APPENDIX A
SEDIMENT TESTING RESULTS

LACO ASSOCIATES CONSULTING ENGINEERS 216 J STREET EUREKA, CA 95501 (707) 443-5054	project: GEOTECHNICAL INVESTIGATION REPORT	by: DNL	figure number: FIG. 2
	location: CRESCENT CITY HARBOR	date: 09/27/96	
	client: U.S. ARMY CORPS OF ENGINEERS	check:	project number: 4382.00
	SITE MAP: BORING LOCATIONS (approx.)	date:	



BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

GRAIN SIZE, TOTAL SOLIDS, AND TOTAL ORGANIC CARBON

Sample ID	Replicate	% Gravel >2.0 mm	% Sand 2.0-0.063 mm	% Silt 0.063-0.004 mm	% Clay <0.004 mm	Solids (%)	TOC (%)
CC1 + CC3	1	12	57	23	8	57	4.80
CC1 + CC3	2	12	58	22	8	57	--
CC2		2	45	40	13	47	9.50
CC4		1	70	20	9	43	12.8

QC ANALYSES: GRAIN SIZE AND TOTAL SOLIDS

	% Gravel	% Sand	% Silt	% Clay	Solids (%)
Replicate Analysis					
CC1 + CC3	12	57	23	8	57
CC1 + CC3	12	58	22	8	57
RPD (%)	0	2	4	0	0

QC ANALYSES: TOC

	TOC (%)
Replicate Analysis	
1101[a]	0.07
1101[a]	0.07
RPD (%)	0
1107[a]	12.81
1107[a]	12.33
RPD (%)	4
SRM	
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.80
SRM Theoretical Value	4.80
PD (%)	0
SRM Result	4.95
SRM Theoretical Value	4.80
PD (%)	3

a = Sample ID number used for QC purposes only; not a client sample ID number.

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

METALS IN ELUTRIATE SAMPLES
(concentrations in μg/L - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag ICP-MS	As ICP-MS	Cd ICP-MS	Cr ICP-MS	Cu ICP-MS	Pb ICP-MS	Ni ICP-MS	Se ICP-MS	Zn CP-MS
1019CC*1		CC1 + CC3	0.00316	0.0326	1.36	0.0317	1.02	2.13	0.253	3.41	0.305	2.69
1019CC*2		CC2	0.00371	0.454	1.49	0.0718	1.46	1.49	0.724	2.75	0.3 U	2.08
1019CC*3	1	CC4	0.00187	0.01 U	2.55	0.0173	0.862	2.30	0.185	2.14	0.3 U	7.62
1019CC*3	2	CC4	0.00193	0.0932	2.78	0.0194	1.24	2.12	0.169	1.93	0.538	3.80
1019CC*7		Control	0.000672	0.513	1.41	0.0727	0.278	1.25	0.0201	2.48	0.3 U	2.48
Blank			0.000118	0.0668	0.1 U	0.01 U	0.0683	0.03 U	0.01 U	0.03 U	0.3 U	2.12
Detection Limits			0.000056	0.01	0.1	0.01	0.03	0.03	0.01	0.03	0.3	0.2
STANDARD REFERENCE MATERIAL												
1641c			1510	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	1470									
		range	±40									
		percent difference	3%	NA	NA	NA	NA	NA	NA	NA	NA	NA
1643d			NA	1.14	59.1	5.94	19.7	20.4	19.0	55.7	10.6	76.9
		certified value		1.27	56.0	6.47	18.5	20.5	18.2	58.1	11.4	72.5
		range		±0.057	±0.73	±0.37	±0.20	±3.8	±0.64	±2.7	±0.17	±0.65
		percent difference	NA	10%	6%	8%	6%	0%	4%	4%	7%	6%

Print Date: 12/19/96

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

METALS IN SEDIMENT SAMPLES
(concentrations in µg/g dry weight - blank corrected)

(CF#1019)

MSL Code	Rep	Sponsor ID	Hg CVAA	Ag GFAA	As XRF	Cd GFAA	Cr XRF	Cu XRF	Pb XRF	Ni XRF	Se GFAA	Zn XRF
1019CC*4		CC1 + CC3	0.147	0.112	8.1	0.55	328	42.8	39.1	157	0.28	119
1019CC*5		CC2	0.120	0.133	9.3	0.70	326	45.2	12.3	181	0.46	108
1019CC*6	1	CC4	0.102	0.103	10.3	0.55	416	49.5	8.5	177	0.46	112
1019CC*6	2	CC4	0.276	0.103	NA	0.65	NA	NA	NA	NA	0.37	NA
Blank			0.0166	0.011	NA	0.021 U	NA	NA	NA	NA	0.16 U	NA
Detection Limits			0.0017	0.005	NA	0.021	NA	NA	NA	NA	0.16	NA
<u>STANDARD REFERENCE MATERIAL</u>												
PACS-1			4.97	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	4.57									
		range	±0.16									
		percent difference	9%	NA	NA	NA	NA	NA	NA	NA	NA	NA
BEST			0.0854	NA	NA	NA	NA	NA	NA	NA	NA	NA
		certified value	0.092									
		range	±0.009									
		percent difference	7%	NA	NA	NA	NA	NA	NA	NA	NA	NA
1646			NA	0.114	12.6	0.30	84	17.9	27.5	29.7	0.46	137
		certified value		NC	11.6	0.36	76	18	28.2	32	0.6 NC	138
		range			±1.3	±0.07	±3	±3	±1.8	±3		±6
		percent difference	NA	NA	9%	17%	11%	1%	2%	7%	23%	1%

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U.S. Army Corps of Engineers, San Francisco District

(CF#1019)

PAHs IN SEDIMENT SAMPLES

MSL ID	1019CC*4	1019CC*5	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC2	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	1	2	1
Wet Wt.	22.54	20.19	21.50	22.03
Units (Dry Weight)	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	56.4	34.1	34.1	30.8
Batch	1	1	1	1
1,4 Dichlorobenzene	2.23 U	4.10 U	10.2	4.15 U
Naphthalene	45.9	48.5	61.8	90.7
Acenaphthylene	3.86	5.69	5.68	6.06
Acenaphthene	22.7	10.4	11.8	22.9
Fluorene	31.3	22.8	26.3	37.5
Dibenzothiophene	12.5	10.0	13.7	22.3
Phenanthrene	79.4	63.4	98.1	152
Anthracene	34.9	34.2	32.5	40.2
Fluoranthene	154	107	158	286
Pyrene	211	173	204	234
Benzo[a]anthracene	52.9	43.7	52.3	86.8
Chrysene	79.4	59.0	83.7	126
Benzo[b]fluoranthene	80.4	86.3	93.5	137
Benzo[k]fluoranthene	33.5	31.5	34.9	50.3
Benzo[e]pyrene	41.8	46.8	51.4	80.7
Benzo[a]pyrene	45.3	48.9	49.2	77.3
Perylene	67.4	95.2	104	66.8
Indeno[1,2,3-c,d]pyrene	25.3	31.6	28.6	45.6
Dibenz[a,h]anthracene	6.77	7.13	7.51	11.9
Benzo[g,h,i]perylene	28.9	38.9	35.7	58.8
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	51	29	57	64
d8 Naphthalene	65	35	69	74
d10 Acenaphthene	67	32	71	79
d10 Phenanthrene	80	39	75	84
d12 Chrysene	82	40	69	76
d12 Perylene	72	34	62	70
d14 Dibenzo[a,h]anthracene	79	38	68	77

U = Not detected at or above MDL.
NA = Not applicable.
NS = Not spiked.

* = Outside Quality Control Limit.

CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN ELUTRIATE SAMPLES

(CF#1019)	Blank	Blank Spike A			Blank Spike B			
MSL ID	1019-BLK	1019-BSA	Spike	Percent	1019-BSB	Spike	Percent	
Client ID	Blank	Blank Spike A	Amount	Recovery	Blank Spike B	Amount	Recovery	RPD
Matrix	Elutriate	Elutriate			Elutriate			
Analytical Replicate	1	1			1			
Volume extracted (mL)	300	300			300			
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%	%
Batch	1	1			1			
1,4 Dichlorobenzene	33.3 U	33.3 U	NS	NA	33.3 U	NS	NA	NA
Naphthalene	64.6 U	183	167	110	178	167	107	1.71
Acenaphthylene	27.6 U	165	167	99	177	167	106	4.88
Acenaphthene	25.7 U	173	167	104	180	167	108	2.76
Fluorene	71.3 U	180	167	108	173	167	104	2.62
Dibenzothiophene	15.1 U	15.1 U	NS	NA	15.1 U	NS	NA	NA
Phenanthrene	15.1 U	175	167	105	175	167	105	0.02
Anthracene	41.0 U	161	167	97	163	167	98	0.78
Fluoranthene	42.3 U	174	167	105	169	167	102	2.01
Pyrene	58.2 U	170	167	102	161	167	97	3.85
Benzo[a]anthracene	73.4 U	171	167	103	174	167	104	1.11
Chrysene	20.1 U	181	167	108	176	167	105	1.92
Benzo[b]fluoranthene	26.3 U	207	167	124	201	167	121	2.07
Benzo[k]fluoranthene	26.5 U	202	167	121	202	167	121	0.06
Benzo[e]pyrene	7.10 U	7.10 U	NS	NA	7.10 U	NS	NA	NA
Benzo[a]pyrene	6.33 U	181	167	108	181	167	108	0.04
Perylene	15.6 U	15.6 U	NS	NA	15.6 U	NS	NA	NA
Indeno[1,2,3-c,d]pyrene	32.6 U	195	167	117	188	167	113	2.48
Dibenz[a,h]anthracene	12.9 U	183	167	110	186	167	111	1.10
Benzo[g,h,i]perylene	64.9 U	193	167	116	188	167	113	1.68
Surrogate Recoveries (%)								
d4 1,4-Dichlorobenzene	34	55			60			
d8 Naphthalene	56	87			99			
d10 Acenaphthene	63	94			102			
d10 Phenanthrene	70	106			111			
d12 Chrysene	87	113			130			
d12 Perylene	79	101			115			
d14 Dibenzo[a,h]anthracene	90	115			131			

U = Not detected at or above MDL.
* = Outside Quality Control Limit.
NS = Not spiked.
NA = Not applicable.

CRESCENT CITY HARBOR SEAFL(
U.S. Army Corps of Engineers, Sar

(CF#1019)
MSL ID
Client ID
Matrix
Analytical Replicate
Volume extracted (mL)
Units
Batch
1,4 Dichlorobenzene
Naphthalene
Acenaphthylene
Acenaphthene
Fluorene
Dibenzothiophene
Phenanthrene
Anthracene
Fluoranthene
Pyrene
Benzo[a]anthracene
Chrysene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Benzo[e]pyrene
Benzo[a]pyrene
Perylene
Indeno[1,2,3-c,d]pyrene
Dibenz[a,h]anthracene
Benzo[g,h,i]perylene
Surrogate Recoveries (%)
d4 1,4-Dichlorobenzene
d8 Naphthalene
d10 Acenaphthene
d10 Phenanthrene
d12 Chrysene
d12 Perylene
d14 Dibenzo[a,h]anthracene
U = Not detected at or above MDL.
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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

CHLORINATED PESTICIDES AND PCBs IN SEDIMENT SAMPLES

(CF#1019)				
MSL ID	1019CC*4	1019CC*5	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	1	2	1
Wet Wt.	22.54	20.19	21.50	22.03
Units (Dry Weight)	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	56.4	34.1	34.1	30.8
Batch	1	1	1	1
alpha-BHC	0.32 U	0.58 U	0.54 U	0.59 U
gamma-BHC	0.22 U	0.40 U	0.38 U	0.41 U
Heptachlor	0.07 U	0.12 U	0.11 U	0.12 U
Aldrin	0.68	0.60	1.22	1.68
beta-BHC	0.32 U	0.58 U	0.54 U	0.59 U
delta-BHC	0.32 U	0.58 U	0.54 U	0.59 U
Heptachlor Epoxide	0.31 U	0.57 U	0.53 U	0.58 U
Endosulfan I	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDE	3.44	2.47	2.44	2.03
Dieldrin	0.21 U	0.38 U	0.36 U	0.39 U
Endrin	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDD	0.26 U	0.48 U	0.45 U	0.49 U
Endosulfan II	0.32 U	0.58 U	0.54 U	0.59 U
4,4'-DDT	0.74 U	1.36 U	1.28 U	1.38 U
Endrin Aldehyde	0.32 U	0.58 U	0.54 U	0.59 U
Endosulfan Sulfate	0.22 U	0.40 U	0.38 U	0.41 U
Chlordane	0.79 U	0.53 U	0.50 U	0.44 U
Toxaphene	0.71 U	0.48 U	0.45 U	0.39 U
Aroclor 1242	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1248	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1254	0.79 U	0.53 U	0.50 U	0.44 U
Aroclor 1260	0.79 U	0.53 U	0.50 U	0.44 U
Surrogate Recoveries (%)				
PCB 103 (SIS)	76	37	71	72
PCB 198 (SIS)	80	27	56	88

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

(CF#1019)

CHLORINATED PESTICIDES AND PCBs IN ELUTRIATE SAMPLES

MSL ID	1019CC*1	1019CC*2	1019CC*2	1019CC*3	1019CC*7
Client ID	CC1 + CC3	CC2	CC2	CC4	Control
Matrix	Elutriate	Elutriate	Elutriate	Elutriate	Elutriate
Analytical Replicate	1	1	2	1	1
Volume extracted (mL)	300	300	300	250	300
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Batch	1	1	1	1	1
alpha-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
gamma-BHC	1.48 U	1.48 U	1.48 U	1.78 U	1.48 U
Heptachlor	1.66 U	1.66 U	1.66 U	2.00 U	1.66 U
Aldrin	1.37 U	1.37 U	1.37 U	1.65 U	1.37 U
beta-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
delta-BHC	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Heptachlor Epoxide	0.39 U	0.39 U	0.39 U	0.47 U	0.39 U
Endosulfan I	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDE	0.98 U	0.98 U	0.98 U	1.18 U	0.98 U
Dieldrin	0.44 U	0.44 U	0.44 U	0.53 U	0.44 U
Endrin	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDD	2.66	1.59 U	1.59 U	1.91 U	1.59 U
Endosulfan II	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
4,4'-DDT	1.43 U	1.43 U	1.43 U	1.71 U	1.43 U
Endrin Aldehyde	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Endosulfan Sulfate	1.64 U	1.64 U	1.64 U	1.97 U	1.64 U
Chlordane	105 U	105 U	105 U	127 U	105 U
Toxaphene	94.0 U	94.0 U	94.0 U	113 U	94.0 U
Aroclor 1242	105 U	105 U	105 U	127 U	105 U
Aroclor 1248	105 U	105 U	105 U	127 U	105 U
Aroclor 1254	105 U	105 U	105 U	127 U	105 U
Aroclor 1260	105 U	105 U	105 U	127 U	105 U
Surrogate Recoveries (%)					
PCB 103 (SIS)	90	88	86	44	76
PCB 198 (SIS)	100	95	90	51	87

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NA = Not applicable.
NS = Not spiked.

BATTELLE MARINE SCIENCES LABORATORY
1529 W. Sequim Bay Road
Sequim, WA 98382
(360) 683-4151

CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

(CF#1019) **BUTYLTINS IN SEDIMENT SAMPLES**

MSL ID	1019CC*4	1019CC*4	1019CC*5	1019CC*6
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4
Matrix	SED	SED	SED	SED
Analytical Replicate	1	2	1	1
Wet Wt.	20.13	20.29	20.39	20.31
Units	ng/g	ng/g	ng/g	ng/g
Percent Dry Wt. (%)	54.7	54.7	50.1	43.6
Batch	1	1	1	1
Tributyltin	3.62	4.62	14.2	3.77
Dibutyltin	0.86	1.74	4.28	2.15
Monobutyltin	1.82 U	1.82 U	2.19	1.82 U
Surrogate Recoveries (%)				
Tripentyltin (SIS)	90	88	95	102

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

BUTYLTINS IN ELUTRIATE SAMPLES

(CF#1019)

MSL ID	1019CC*1	1019CC*1	1019CC*2	1019CC*3	1019CC*7
Client ID	CC1 + CC3	CC1 + CC3	CC2	CC4	Control
Matrix	Elutriate	Elutriate	Elutriate	Elutriate	Elutriate
Analytical Replicate	1	2	1	1	1
Volume extracted (mL)	300	300	300	250	300
Units	ng/L	ng/L	ng/L	ng/L	ng/L
Batch	1	1	1	1	1
Tributyltin	3.43	3.57	5.86	3.07 U	3.07 U
Dibutyltin	5.34	5.85	6.45	5.24	12.0 U
Monobutyltin	10.8 U	10.8 U	10.8 U	10.8 U	10.8 U
Surrogate Recoveries (%)					
Tripentyltin (SIS)	48	54	44	57	55

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike Amount*	*Percent Recovery*	1019-BSB	*Spike Amount*	*Percent Recovery*	RPD
Client ID	Blank	Blank Spike A			Blank Spike B			
Matrix	SED	SED	SED		SED			
Analytical Replicate	1	1	1		2			
Wet Wt.								
Units (Dry Weight)	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	%
Percent Dry Wt. (%)				NA		NA	NA	
Batch	1	1	1	1	1	1	1	
	1019S-BLK	1019S-BSA			1019S-BSB			
1,4 Dichlorobenzene	3.11 U	3.11 U	NS	NA	3.11 U	NS	NA	NA
Naphthalene	3.11 U	27.9	27.5	101	27.4	27.5	100	1.25
Acenaphthylene	3.30 U	25.2	27.5	92	25.5	27.5	93	0.81
Acenaphthene	2.96 U	26.9	27.5	98	26.0	27.5	95	2.38
Fluorene	5.89 U	27.6	27.5	100	23.6	27.5	86	10.9
Dibenzothiophene	1.10 U	1.10 U	NS	NA	1.10 U	NS	NA	NA
Phenanthrene	6.96 U	32.0	27.5	116	33.0	27.5	120	2.20
Anthracene	8.46 U	22.5	27.5	82	21.8	27.5	79	1.95
Fluoranthene	3.20 U	26.3	27.5	96	25.0	27.5	91	3.69
Pyrene	2.38 U	27.6	27.5	100	25.8	27.5	94	4.66
Benzo[a]anthracene	1.16 U	23.7	27.5	86	23.2	27.5	84	1.48
Chrysene	1.29 U	28.4	27.5	103	27.8	27.5	101	1.33
Benzo[b]fluoranthene	2.44 U	33.8	27.5	123	31.9	27.5	116	4.05
Benzo[k]fluoranthene	4.13 U	24.9	27.5	127	32.5	27.5	118	4.91
Benzo[e]pyrene	2.70 U	2.70 U	NA	NA	2.70 U	NA	NA	NA
Benzo[a]pyrene	3.22 U	30.0	27.5	109	30.2	27.5	110	0.31
Perylene	28.8 U	28.8 U	NA	NA	28.8 U	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	1.48 U	27.9	27.5	102	27.7	27.5	101	0.59
Dibenz[a,h]anthracene	1.87 U	28.6	27.5	104	29.2	27.5	106	1.49
Benzo[g,h,i]perylene	1.35 U	27.4	27.5	98	27.0	27.5	98	0.91
Surrogate Recoveries (%)								
d4 1,4-Dichlorobenzene	51	29			57			
d8 Naphthalene	65	35			69			
d10 Acenaphthene	67	32			71			
d10 Phenanthrene	80	39			75			
d12 Chrysene	82	40			69			
d12 Perylene	72	34			62			
d14 Dibenzo[a,h]anthracene	79	38			68			

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Sequim, WA 98382
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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: CHLORINATED PESTICIDES AND PCBs IN ELUTRIATE SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike*	*Percent*	1019-BSB	*Spike*	*Percent*	
Client ID	Blank	Blank Spike A	*Amount*	*Recovery*	Blank Spike B	*Amount*	*Recovery*	RPD
Matrix	Elutriate	Elutriate			Elutriate			
Analytical Replicate	1	1			1			
Volume extracted (mL)	300	300			300			
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%	%
Batch	1	1			1			
alpha-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
gamma-BHC	1.48 U	11.9	16.7	71	10.8	16.7	65	10
Heptachlor	1.66 U	15.0	16.7	90	15.4	16.7	92	2
Aldrin	1.37 U	15.4	16.7	92	15.2	16.7	92	1
beta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
delta-BHC	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
Heptachlor Epoxide	0.39 U	0.39 U	NS	NA	0.39 U	NS	NA	NA
Endosulfan I	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
4,4'-DDE	0.98 U	52.3	NS	NA	21.3	NS	NA	NA
Dieldrin	0.44 U	37.7	33.3	113	29.6	33.3	89	24
Endrin	1.64 U	34.2	33.3	103	30.8	33.3	92	11
4,4'-DDD	1.59 U	1.59 U	NS	NA	1.59 U	NS	NA	NA
Endosulfan II	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
4,4'-DDT	1.43 U	37.1	33.3	111	33.0	33.3	99	12
Endrin Aldehyde	1.64 U	1.64 U	NS	NA	3.30	NS	NA	NA
Endosulfan Sulfate	1.64 U	1.64 U	NS	NA	1.64 U	NS	NA	NA
Chlordane	105 U	105 U	NS	NA	105 U	NS	NA	NA
Toxaphene	94.0 U	94.0 U	NS	NA	94.0 U	NS	NA	NA
Aroclor 1242	105 U	105 U	NS	NA	105 U	NS	VV	NA
Aroclor 1248	105 U	105 U	NS	NA	105 U	NS	NA	NA
Aroclor 1254	105 U	451	333	136	105 U	333	123	10
Aroclor 1260	105 U	105 U	NS	NA	105 U	NS	NA	NA
Surrogate Recoveries (%)								
PCB 103 (SIS)	77	113			121			
PCB 198 (SIS)	95	154			164			

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: CHLORINATED PESTICIDES AND PCBS IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			
MSL ID	1019-BLK	1019-BSA	*Spike*	*Percent*	1019-BSB	*Spike*	*Percent*	
Client ID	Blank	Blank Spike A	*Amount*	*Recovery*	Blank Spike B	*Amount*	*Recovery*	RPD
Matrix	SED	SED	SED		SED			
Analytical Replicate	1	1	1		2			
Wet Wt.	21.6	21.6			21.6			
Units (Dry Weight)	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	%
Percent Dry Wt. (%)	38.9	38.9		NA	38.9	NA	NA	
Batch	1	1	1	1	1	1	1	
alpha-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
gamma-BHC	0.34 U	1.95	3.10	63	1.91	3.10	62	2
Heptachlor	0.10 U	2.60	3.10	84	2.59	3.10	84	0
Aldrin	0.33 U	3.01	3.10	97	2.78	3.10	90	8
beta-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
delta-BHC	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
Heptachlor Epoxide	0.49 U	0.49 U	NS	NA	0.49 U	NS	NA	NA
Endosulfan I	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
4,4'-DDE	0.23 U	1.97	NS	NA	2.01	NS	NA	NA
Dieldrin	0.33 U	5.20	6.20	84	5.04	6.20	81	3
Endrin	0.50 U	5.86	6.20	95	5.79	6.20	93	1
4,4'-DDD	0.41 U	0.41 U	NS	NA	0.41 U	NS	NA	NA
Endosulfan II	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
4,4'-DDT	1.16 U	6.20	6.20	100	6.06	6.20	98	2
Endrin Aldehyde	0.50 U	0.50 U	NS	NA	0.50 U	NS	NA	NA
Endosulfan Sulfate	0.34 U	0.34 U	NS	NA	0.34 U	NS	NA	NA
Chlordane	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Toxaphene	0.51 U	0.51 U	NS	NA	0.51 U	NS	NA	NA
Aroclor 1242	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Aroclor 1248	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Aroclor 1254	0.57 U	68.7	62.0	111	69.0	62.0	111	0
Aroclor 1260	0.57 U	0.57 U	NS	NA	0.57 U	NS	NA	NA
Surrogate Recoveries (%)								
PCB 103 (SIS)	74	106			88			
PCB 198 (SIS)	74	96			86			

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: PAHs IN SEDIMENT SAMPLES

Replicate Analysis

(CF#1019)				
MSL ID	1019CC*5	1019CC*5	Mean	RPD
Client ID	CC2	CC2		
Matrix	SED	SED		
Analytical Replicate	1	2		
Wet Wt.	20.19	21.50		
Units (Dry Weight)	ng/g	ng/g	ng/g	%
Percent Dry Wt. (%)	34.1	34.1		
Batch	1	1		
1,4 Dichlorobenzene	4.10 U	10.2	NA	NA
Naphthalene	48.5	61.8	55.1	24
Acenaphthylene	5.69	5.68	5.69	NA
Acenaphthene	10.4	11.8	11.1	NA
Fluorene	22.8	26.3	24.5	14
Dibenzothiophene	10.0	13.7	11.9	32 *
Phenanthrene	63.4	98.1	80.7	43 *
Anthracene	34.2	32.5	33.3	5
Fluoranthene	107	158	133	38 *
Pyrene	173	204	189	16
Benzo[a]anthracene	43.7	52.3	48.0	18
Chrysene	59.0	83.7	71.4	35 *
Benzo[b]fluoranthene	86.3	93.5	89.9	8
Benzo[k]fluoranthene	31.5	34.9	33.2	10
Benzo[e]pyrene	46.8	51.4	49.1	10
Benzo[a]pyrene	48.9	49.2	49	0.6
Perylene	95.2	104	99.4	8
Indeno[1,2,3-c,d]pyrene	31.6	28.6	30.1	10
Dibenz[a,h]anthracene	7.13	7.51	7.32	NA
Benzo[g,h,i]perylene	38.9	35.7	37.3	9
Surrogate Recoveries (%)				
d4 1,4-Dichlorobenzene	29	57		
d8 Naphthalene	35	69		
d10 Acenaphthene	32	71		
d10 Phenanthrene	39	75		
d12 Chrysene	40	69		
d12 Perylene	34	62		
d14 Dibenzo[a,h]anthracene	38	68		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN SEDIMENT SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*			*SRM*		
MSL ID	10192-BLK	10192-SPK-BLKA	*Spike*	*Percent*	10192-SPK-BLKB	*Spike*	*Percent*	1019-PACS	*Certified*	*Percent*
Client ID	Blank	Blank Spike A	*Amount*	*Recovery*	Blank Spike B	*Amount*	*Recovery*		*Value*	*Difference*
Matrix	SED	SED			SED			SED	SED	SED
Analytical Replicate	2	2			2			2		
Dry Wt. (g)	NA	NA			NA			0.49		
Units	ng/g	ng/g	ng/g	%	ng/g	ng/g	%	ng/g	ng/g	%
Batch	1	1	1	1	1	1	1	1	1	1
Tributyltin	0.482 U	50.1	51.2	98	52.9	51.2	103	734	1271	58
Dibutyltin	0.559 U	50.1	51.4	98	49.7	51.4	97	669	1165	57
Monobutyltin	1.82 U	17.8	44.3	40	17.2	44.3	39	226	280	81
Surrogate Recoveries (%)										
Tripentyltin (SIS)	86	98			91			94		

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CRESCENT CITY HARBOR SEAFLOOR CHARACTERIZATION STUDY
U.S. Army Corps of Engineers, San Francisco District

QC ANALYSES: BUTYLTINS IN ELUTRIATE SAMPLES

(CF#1019)	*Blank*	*Blank Spike A*			*Blank Spike B*		
MSL ID	1019W-BLK	1019-SPK-BLKA	*Amount*	*Percent*	1019-SPK-BLKB	*Spike*	*Percent*
Client ID			*Spiked*	*Recovery*		*Amount*	*Recovery*
Matrix	Elutriate	Elutriate			Elutriate		
Analytical Replicate	1	1			2		
Volume extracted (mL)	300	300			300		
Units	ng/L	ng/L	ng/L	%	ng/L	ng/L	%
Batch	1	1	1	1	1	1	1
Tributyltin	93.4	368	425	65	411	425	75
Dibutyltin	12.0 U	372	428	87	348	428	81
Monobutyltin	10.8 U	190	369	52	167	369	45
Surrogate Recoveries (%)							
Tripentyltin (SIS)	50	18			33		

U = Not detected at or above MDL.

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
333 MARKET ST.
SAN FRANCISCO, CALIFORNIA 94105-2197

July 1, 1998

Planning/Engineering Division

Mr. Jim Bybee
Northern Area Environmental Coordinator
National Marine Fisheries Service
Habitat Conservation Branch
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

Dear Mr. Bybee:

The Corps of Engineers, San Francisco District has completed preparation of the enclosed *Draft Environmental Assessment, Biological Assessment and Consistency Determination, Crescent City Harbor Federal Channel Extension and Deepening General Re-evaluation Report, Crescent City Harbor, Del Norte County, California,* dated May 1998.

The proposed action is to dredge an approximately 1,200 foot long access channel from the existing Federal Inner Harbor Channel to the entrance of the Small Boat Basin located at Crescent City Harbor, City of Crescent City, Del Norte County, California. The channel bottom width would range from 140 feet to 210 feet where it would flare to meet the Inner Harbor Channel. The proposed channel would be dredged to -14 feet mean lower low water with an additional two-foot overdepth allowance. The dredging method is anticipated to be a hydraulic operation. The resulting 19,400 cubic yards of dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site. Construction of the channel is expected to last 4 to 5 days, and would occur in the winter of 1998/1999.

A draft Biological Assessment, which addresses your January 29, 1996 letter, is included in the enclosed document. The Biological Assessment concludes that no listed or proposed species would be affected by the proposed project. The Corps requests concurrence on this conclusion from the National Marine Fisheries Service. Please provide any comments to our office within 30 days from receipt of this letter. If you have any questions regarding this proposed project, please direct them to Eric Jolliffe of our Environmental Planning Section at (415) 977-8543.

Sincerely,

Thomas R. Kendall
Acting Chief, Planning/Engineering Division

Enclosure

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
333 MARKET ST.
SAN FRANCISCO, CALIFORNIA 94105-2197

July 1, 1998

Planning/Engineering Division

Mr. Wayne White
Field Supervisor
U.S. Fish and Wildlife Service
Sacramento Field Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95825

Dear Mr. White:

The Corps of Engineers, San Francisco District has completed preparation of the enclosed *Draft Environmental Assessment, Biological Assessment and Consistency Determination, Crescent City Harbor Federal Channel Extension and Deepening General Re-evaluation Report, Crescent City Harbor, Del Norte County, California,* dated May 1998.

The proposed action is to dredge an approximately 1,200 foot long access channel from the existing Federal Inner Harbor Channel to the entrance of the Small Boat Basin located at Crescent City Harbor, City of Crescent City, Del Norte County, California. The channel bottom width would range from 140 feet to 210 feet where it would flare to meet the Inner Harbor Channel. The proposed channel would be dredged to -14 feet mean lower low water with an additional two-foot overdepth allowance. The dredging method is anticipated to be a hydraulic operation. The resulting 19,400 cubic yards of dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site. Construction of the channel is expected to last 4 to 5 days, and would occur in the winter of 1998/1999. Due to time constraints, initial construction would occur just after the August to November window recommended in the draft Coordination Act Report to protect Coho salmon, which could be in the area. Since the construction period is so brief, and just outside the recommended window, it is very unlikely that the species would be affected. All subsequent maintenance dredging of the access channel would occur within the recommended window.

A draft Biological Assessment, based on the April 8, 1996 species list received from your office, is incorporated into the enclosed document. The Biological Assessment concludes that no listed or proposed species would be affected by the proposed project. The Corps requests concurrence on this conclusion from the Service. Please provide any comments to our office within 30 days from receipt of this letter. If you have any questions regarding this proposed project, please direct them to

Eric Jolliffe of our Environmental Planning Section at (415) 977-8543.

Sincerely,

Thomas R. Kendall
Acting Chief, Planning/Engineering Division

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
COASTAL CALIFORNIA FISH AND WILDLIFE OFFICE
1125 16TH STREET, ROOM 209
ARCATA, CA 95521
(707) 822-7201
FAX (707) 822-8136

In Reply Refer To: 1-14-1998-150

August 3, 1998

Thomas R. Kendall
Acting Chief, Planning/Engineering Divisio
Department of the Army
San Francisco District, Corps of Engineers
333 Market St.
San Francisco, California 94105-2197

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL	# of pages ▶ 5
To Peter La Civita	From Randy Brown
Dept./Agency	Phone # 707-822-7201
Fax # (415) 977-8695	Fax #
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

Subjects: Crescent City Harbor Federal Channel Extension and Deepening
Crescent City Harbor Federal Channels O&M Dredging Project, FY 1998

Dear Mr. Kendall:

The U.S. Fish and Wildlife Service (Service) has received your request for concurrence in regards to the two subject dredging projects in Crescent City Harbor and vicinity in Del Norte County, California. The Service does not concur with the Army Corps of Engineers (Corps) determination that the projects are not likely to adversely affect the American peregrine falcon (*Falco peregrinus anatum*), brown pelican (*Pelecanus occidentalis*), northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), bald eagle (*Haliaeetus leucocephalus*), Aleutian Canada goose (*Branta canadensis leucoparaeia*), western snowy plover (*Charadrius alexandrinus nivosus*), leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), olive Ridley sea turtle (*Lepidochelys olivacea*), loggerhead sea turtle (*Carette caretta*), tidewater goby (*Eucyclogobius newberryi*),Oregon silverspot butterfly (*Speyeria zerene hippoltya*), Mc Donald's Rock Cress (*Arabis mcdonaldiana*), Wolf's evening primrose (*Oenothera wolfii*), and western lily (*Lilium occidentale*).

The Service has included both of the subject proposed projects in this response letter due to the similarity of effects that might occur from implementation of the proposed projects, as well as the interrelated and interdependent nature of the project due their immediate physical proximity. We recommend you address the effects of these two projects as one project for all subsequent reviews.

The first proposed project entails the dredging of an approximately 1,200 foot long access channel from the existing Federal Inner Harbor Channel to the entrance of the Small Boat Basin

located at Crescent City Harbor, City of Crescent City, Del Norte County, Oregon. The channel bottom width would range from 140 feet to 210 feet where it would flare to meet the Inner Harbor Channel. The proposed channel would be dredged to -14 feet mean lower low water with an additional two-foot overdepth allowance. The dredging method is anticipate to be a hydraulic operation. The resulting 19,400 cubic yards of dredged material would be transported through a pipeline to the Harbor District's nearshore disposal site. Construction of the channel is expected to last 4 to 5 days, and would occur in the winter of 1998/1999. Your request for concurrence with a determination of *no effect* on this project was received by the Sacramento Fish and Wildlife Office (SFWO) on July 8, 1998. SFWO forwarded your request to the Coastal California Fish and Wildlife Office (CCFWO), who received this request on July 20, 1998.

The second proposed project would maintenance dredge an estimated 18,000 cubic yards of silty/sand material from the Inner Harbor Basin Channel, and an estimated 52,000 cubic yards of sandy material from the Entrance Channel to Crescent City Harbor. The Inner Harbor Basin Channel would be dredged to -15 feet mean lower low water and the entrance channel would be dredged to -20 feet mean lower low water. Dredging and disposal of the estimated 70,000 cubic yards of dredge material would be performed by either an hydraulic-hopper dredge, hydraulic pipeline dredge, or clamshell and barge. Disposal would involve *indirect beach nourishment* of South Beach by disposal at the *Whaler Island Disposal Site*. The proposed project is scheduled to begin in mid-to-late August, and conclude 30 days later in mid-to-late September, 1998. Your request for concurrence with a determination of *no effect* on this project was received by the CCFWO on July 6, 1998.

The Service has reviewed the Environmental Analysis/Draft Biological Assessments prepared by the Corps for these two proposed projects. Our comments, as they concern species listed as threatened or endangered under the Endangered Species Act of 1973, as amended (Act), are incorporated into one response letter due to the similar nature and location of the two proposed projects. The following specific points describe the Service's primary concerns about the likely impacts of the proposed project on listed species. Following each concern, we identify specific requests for Corps action or analysis to address these concerns.

1. The Corps bases its determination of no effect for several listed species on the presumption that the size of the project is relatively small. For example, the Draft Biological Assessment for the second project states (page 13, paragraph 4) "As the footprint of the proposed maintenance dredging project is relatively small, there would be no significant effect on the food resource for local wildlife". This statement and its implications appear to be in direct conflict with previous text, which states "To illustrate the magnitude of average 'direct' beach nourishment coverage; 72,000 cys [cubic yards] of sand is enough to form a beach approximately 2 feet deep, 100 feet wide for one-mile long". The Service disagrees with the Corps assessment that the footprint of the project would have no effect on the food resource for local wildlife. The footprint is large enough to affect the benthic community.

2. The Draft Biological Assessment relies substantially on the conclusion that because listed species of (nonfish) vertebrates are "highly mobile", no adverse effects could occur to these species since they would have the ability to move out of harms way during the dredging operation. Whereas there may be relatively little risk of these species suffering

direct mortality from the dredging operation, the Draft Biological Assessment has not addressed the likelihood of adverse impacts to these species from disturbance of normal activities related to foraging and roosting in the project area. Specifically, the analysis should address the likelihood that the proposed project could result in incidental take due to harassment of listed species at sites used for activities related to feeding, breeding and sheltering. Species under the section 7 regulatory jurisdiction of the Service for which this concern applies would include the marbled murrelet, brown pelican, western snowy plover, American peregrine falcon and bald eagle.

3. Similar to the concern identified in the preceding item, the Service requests an additional analysis of the loss of forage base due to the direct removal of substrate that provides habitat for prey species for the abovementioned listed species. In addition, an analysis of the effect of a temporary reduction in dissolved oxygen levels on prey species should be addressed to determine the impact on piscivorous listed species. Specifically, the analysis should address the likelihood that the proposed project could result in incidental take to listed species due to loss of habitat components for activities related to feeding, breeding and sheltering.

4. The Service is unaware of any surveys which indicate that approximately 100 pairs of peregrine falcons occur within the Del Norte and Humboldt Counties area. We request that the Corps review these data and prepare a reanalysis.

5. The Service has concerns related to the potential release of toxics during the dredging operation, including heavy metals, pesticides and petroleum products. Disposal of these dredge materials at the proposed disposal site (Whaler Island) could result in the release of these toxics through indirect beach nourishment to South Beach and adjacent marine habitats. Since pesticides and other toxic chemicals contribute to risk for some listed species, we request that your analysis of the potential for toxic waste release be expanded to address listed species.

6. The analysis in the Draft Biological Assessment (page 15) indicates that the population levels of Aleutian Canada geese are low. This statement conflicts with data previously reported in the document, which indicates that approximately 12,000 geese were counted in a 1993 survey in Crescent City. The determination of *no effect* is based on the assumption that due to low populations, the use of the project area is unpredictable. The Service requests that the Corps summarize the available data regarding Aleutian Canada goose use of Castle Rock and the adjacent marine environment to ascertain the potential impacts of the proposed project to this species.

7. You indicate that the beach area near the project is frequented by runners, vehicles, and dogs, making it unlikely that snowy plovers would nest. However, other beaches in the area are also frequented by runners, vehicles and dogs and have documented nesting. Therefore, if the habitat is suitable, the Service assumes nesting populations of plover may occur unless survey data show otherwise. In addition, the effects analysis needs to consider indirect beach nourishment of wintering habitat along South Beach and Whaler Island. The Service requests that the Corps analyze these potential adverse effects to wintering populations of snowy plover due to habitat modification from indirect beach

nourishment.

8. The Corps does not report any surveys for tidewater goby in the project vicinity, but does indicate that potential habitat for gobies exists at the mouth of Elk Creek. The determination of no effect for this species seems to be based on a distance factor of 0.5 mile, with no assessment of actual effects due to potential sedimentation of spawning or dispersal habitat in the Elk Creek area. Additional clarification on the 0.5 mile distance factor is needed. The Service requests a more detailed analysis of the potential for adverse effects to tidewater goby from the proposed project, including a more quantitative documentation of the classification as "marginal habitat".

9. None of the effects determinations include an analysis of cumulative effects that are likely to result from the implementation of the project. Examples of cumulative effects could include, but are not limited to the following: effect on foraging activities of piscivorous species attributed to increased boat traffic (both numbers and maximum size) in the harbor and entrance channel due to an increase in channel size; and effect on disturbance of snowy plovers in wintering habitat attributed to increased human use of the South Beach and beach strand on Whaler Island. The Service requests that the Corps address whatever cumulative effects might occur to listed species as a result of the implementation of both of these projects.

The Service anticipates no additional requests for information are necessary for a concurrence with your *no effect* determinations for species not specifically addressed by these concerns. Also note that the anadromous fish species and marine mammal species addressed under your Draft Biological Assessment are under the section 7 regulatory jurisdiction of the National Marine Fisheries Service.

Should the analysis of effects show the proposed project may affect listed species, section 7 allows the Service up to 90 days to conclude formal consultation with your agency and an additional 45 days to prepare our biological opinion (unless we mutually agree to an extension).

As a reminder, the Endangered Species Act requires that after initiation of formal consultation, the Federal action agency make no irreversible or irretrievable commitment of resources that limits future options. This practice insures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

If you have questions or concerns please contact Ray Bosch of my staff (707 822-7201).

Sincerely,

Bruce G. Halstead

Bruce G. Halstead
Project Leader

cc:
NMFS, ATTN: D. Butler, Santa Rosa, California
FWS, ATTN: R. Brown, Arcata, California
FWS, ATTN: W. Amy, Sacramento, California

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
333 MARKET ST.
SAN FRANCISCO, CALIFORNIA 94105-2197

September 30, 1998

Environmental Planning Section

Mr. Bruce Halstead, Project Leader
U. S. Fish and Wildlife Service
Coastal California Fish & Wildlife Service
Attn: Ray Bosch
1125 11th Street, Room 209
Arcata, California 95521

Subject: *Crescent City Harbor Federal Channels O&M Dredging Project - FY 1998*
Crescent City Harbor Federal Channel Extension & Deepening - FY 1999

Dear Mr. Halstead:

This letter is in response to your comment letter, dated August 3, 1998 on the two projects referenced above.

The *Crescent City Harbor Federal Channels O&M Dredging Project - FY 1998* was discussed in an interagency meeting/conference call on June 4, 1998 (page 4 in the Draft Environmental Assessment). The *Draft Environmental Assessment for Crescent City Harbor Federal Channels O&M Dredging Project*, Del Norte County, California, dated June 1998, was released for a 30-day public and agency review from July 6th through August 6th, 1998. At the meeting and afterwards, agencies were in agreement with the proposed project, which included placement of suitable dredged material at the *Whaler Island Beach Disposal Site*. In addition, the *Whaler Island Beach Disposal Site* has been previously used for disposal of suitable dredged material. On August 12, 1998, the California Coastal Commission (CCC) concurred with the Consistency Determination (CD-80-98) discussed in the Draft EA. Please note that Federal maintenance dredging occurs in Crescent City on a 5-year cycle, and last occurred in September 1993.

The *Draft Crescent City Harbor Federal Channel Extension & Deepening Project General Investigation Report - FY 1998 (with Draft Environmental Assessment)* is presently out for 30-day public and agency review. This project is not scheduled to begin until early to mid-year 1999, and must go through the Corps' Washington Level Review prior to authorization by Congress and implementation. Thus, this project is not an approved Federal project as is the maintenance dredging project.

Following are the responses to the Service's specific numbered concerns for the Corps' further action or analysis:

1. ***Comment:*** "The Corps bases its determination of no effect for several listed species on the presumption that the size of the project is relatively small. ....This statement and its implications

appear to be in direct conflict with the previous text, which states "To illustrated the magnitude of average "direct" beach nourishment...The footprint is large enough to affect the benthic community."

__Response:__ Please read over pages 6-7 in the *Draft Environmental Assessment for Crescent City Harbor Federal Channels O&M Dredging Project*, dated June 1998. The statement you refer to in your comment is for *direct* placement of sandy dredged material on the South Beach on top of razor clams. *Indirect* beach nourishment at the *Whaler Island Beach Disposal Site* is expected to be more like nearshore disposal in the water and the sandy dredged material would be carried by the littoral drift and "indirectly nourish South Beach". A large pile of sand is not going to either fall in a huge mass on or travel down the coast and smother the benthic invertebrates. If there is an impact to benthic invertebrates, it will be a short-term impact that is associated with all maintenance dredging and deepening projects.

2. *__Comment:__* "The Draft Biological Assessment relies substantially on the conclusion that because listed species of (non-fish) vertebrates are "highly mobile", no adverse effects could occur to these species since they would have the ability to move out of harms way during the dredging operation..... the Draft Biological Assessment has not addressed the likelihood of adverse impacts to these species from disturbance of normal activities relayed to foraging and roosting in the project area. Specifically, the analysis should address the likelihood that the proposed project could result in incidental take due to harassment of listed species at sites used for activities related to feeding, breeding, and sheltering. Species under the Section 7......for which this concern applies would include the marbled murrelet, brown pelican, western snowy plover, American peregrine falcon, and bald eagle..."

__Response:__ All of these species are highly mobile, and in the past history of maintenance dredging and other Corps activities such as repairing the breakwaters at Crescent City, no incidental take due to harassment has occurred to species. In addition, the FWS states in it's *Programmatic Consultation and Conference for Listed Coastal Species, Ventura, Santa Barbara, San Luis Obispo, Monterey and Santa Cruz Counties, California* (1-8-96-F-11; dated August 29, 1997 and enclosed), "for southern sea otters, western snowy plovers, least terns, and brown pelicans, this biological opinion includes only actions that are unlikely to result in mortality or injury. These species are likely to leave work area as a result of human activities without deliberate harassment." There is no breeding habitat for peregrine falcons in the area, nor protected cliffs for cover. They may hunt near Crescent City Harbor. No nesting habitat or breeding habitat for brown pelican occurs in the project area, although, they may forage in the harbor. There is no breeding, roosting, nesting habitat for bald eagles either in the immediate project area. The bald eagle may forage in the harbor and is highly mobile; therefore, no impacts are expected to occur to this species. There is no known roosting, nesting habitat, or breeding habitat, near the project area for marbled murrelets. Therefore, there are no impacts expected to occur to this species either. The maintenance dredging project will be conducted outside the nesting season of snowy plovers. If there are foraging plovers in the area, which is frequented by many pets, joggers, off-road vehicles, etc., they are highly mobile and can avoid the temporary impacts from both the maintenance dredging project and short-term deepening project. The Corps, San Francisco District, has conducted maintenance dredging up and down the coast of California, with no reported incidental take due to harassment. In addition, *indirect beach nourishment* could provide additional foraging habitat and opportunities for shorebirds.

3. ***Comment:*** "Similar to the concern identified in the preceding item, the Service requests an additional analysis of loss of forage base due to the direct removal of substrate that provides habitat for prey species for the aforementioned species....Specifically, the analysis should address the likelihood that the proposed project could result in incidental take to listed species due to loss of habitat components for activities related to feeding, breeding, and sheltering."

   Response: Since the navigation channels comprise a very small percentage of habitat in the Crescent City Harbor, the scope and effect of any potential impacts are localized and temporary, and in addition, the Federal navigation channels are maintenance dredged on a regular 5-year cycle; the Crescent City Harbor district conducts their own annual maintenance dredging; and due to the highly dynamic environment with constant movement of sediment in and out of the channels, it is highly unlikely that benthic invertebrates are able to recolonize as readily as in undisturbed areas of the harbor. Nevertheless, no significant effects are expected to occur.

4. ***Comment:*** "The Service is unaware of any surveys which indicate that approximately 100 pairs of peregrine falcons..."

   Response: Please refer to the Biological Assessment contained within the Corps' *Final Feasibility Report and Environmental Impact Statement/Report (EIS/EIR) for the Humboldt Harbor & Bay Deepening Project*, dated April 1995. On page 4-67, the EIS/EIR states *"Approximately 100 pairs were counted in recent USFWS surveys in mainly Humboldt and Del Norte Counties (Shoulak 1994)."* This information was also provided by the Service in information sent to the Corps in 1994 and 1995 for the annual Humboldt Spring and Fall O&M Dredging Projects Environmental Assessments.

5. ***Comment:*** "The Service has concerns related to the potential release of toxic during the dredging operation, including heavy metals, pesticides, and petroleum products. Disposal of these dredge materials...."

   Response: Please refer to section on ***Sediment Quality Testing*** (page 22) in the *Draft Environmental Assessment for Crescent City Harbor Federal Channels O&M Dredging Project*, dated June 1998. In addition, refer to the sediment testing write-up contained within the *FY 1993 Crescent City Harbor O&M Dredging Project Environmental Assessment*, dated August 1993. In FY 1993, the Corps contractor conducted physical grain-size analysis, bulk sediment chemistry testing, and biological testing (both solid-phase and suspended-particulate phase) on both the Inner Harbor Basin and Entrance Channels. This FY 1993 biological testing sediment data was collected to establish a "baseline sediment testing" data point for Crescent City Harbor O&M Dredging Projects. In FY 1998, EPA, the North Coast Regional Water Quality Control Board (NCRWQCB), CCC, and the San Francisco District agreed that sediment testing only needed to include physical grain-size analysis, but the Corps also collected bulk sediment chemistry data, all in accordance with the *Green Book* The Corps strictly adheres to either the *Green Book* or the *Inland Testing Manual* for sediment testing. The Corps does not dredge and dispose of any material that is not suitable for beach nourishment and/or upland disposal.

6. ***Comment:*** "The analysis in the Draft Biological Assessment (page 15) indicates that the population levels of Aleutian Canada Geese are low. ..."

Response: Please refer to the Biological Assessment contained within the Corps' *Final Feasibility Report and Environmental Impact Statement/Report (EIS/EIR) for the Humboldt Harbor & Bay Deepening Project*, dated April 1995. On page 4-69, the EIS/EIR states *"Approximately 12,000 geese were counted in a 1993 USFWS survey in Crescent City (Shoulak 1994)."* In addition, the Service provided the statement in the same document regarding *"since their populations are low, use of the project area by the Aleutian Canada Goose is unpredictable (USFWS 1994)."* The Corps will remove this contradictory statement from the Final EA regarding low population levels, as this may have referred only to Humboldt Bay region and not Crescent City directly.

In the *Draft Crescent City Harbor Federal Channel Extension & Deepening Project General Investigation Report - FY 1998*, it states for Aleutian Canada geese that *"Today the only breeding populations occur on Buldir and Chagulak Islands in the Aleutians. The pasture just north of Crescent City and Castle Rock are used by the geese during fall and spring migrations to and from their wintering grounds that in the Central Valley. As these geese do not use the immediate project area, the proposed action would have no effect on them."*

7. ***Comment:*** "You indicate that the beach area near the project is frequented by runners, vehicles, and dogs, making it unlikely that snowy plovers would nest. Therefore, if the habitat is suitable, the Service assumes nesting populations of snowy plovers may occur unless survey data show otherwise......The Service requests that the Corps analyze these potential adverse effects to wintering populations of snowy plover due to habitat modification from *indirect beach nourishment.*

   Response: On September 11, 1998, a Corps biologist conducted a field trip to *Whaler Island* to determine if foraging snowy plovers are present. The biologist observed no sign of plovers or any others shorebirds foraging at this time. The perched beach at *Whaler Island* is located in a highly-disturbed environment with many people strolling and driving on the road immediately adjacent to the disposal area - the same road that is used by vehicles to travel from the mainland to the island; dogs were running loose in the 500 plus parking spaces located in the parking lot adjacent to the island; and joggers run by on the same road. The perched beach area is located in a small v-shaped area between the rubble-mound sand barrier (this is what the road to the island is built upon) and the 280-foot extension of an existing stockpile groin, and most likely only provides feeding habitat for seabirds. Since there are no dunes or vegetation growing on this small perched beach, and it is highly disturbed; it is highly unlikely that snowy plovers would nest or even forage there.

8. ***Comment:*** "The Corps does not report any surveys for tidewater goby in the project vicinity, but does indicate that potential habitat exists in the mouth of Elk Creek....The determination of no effect for this species seems to be based on a distance factor of 0.5 miles, with no actual assessment of actual effects due to potential sedimentation of spawning or dispersal habitat in the Elk Creek area......."

   Response: On September 11, 1998, the Corps conducted a field trip up to Crescent City Harbor to determine if the habitat at the mouth of Elk Creek could support the tidewater goby. The mouth of Elk Creek is located at least 0.5 miles from the area in which maintenance dredging and/or the deepening project is planned to occur. From the short field trip it was determined that this creek area would be at best marginal habitat (i.e., in-channel habitat was trash-strewn, and had little

If you have any additional questions or require additional information, please contact Tamara Terry of the Environmental Planning Section at (415) 977-8445, for the *Final Environmental Assessment for Crescent City Harbor Federal Channels O&M Dredging Project - FY 98;* and Eric Jolliffe of the Environmental Planning Section at (415) 977-8543, for the *Crescent City Harbor Federal Channel Extension & Deepening Project General Re-evaluation Report - FY 1998.*

Sincerely,

Peter E. LaCivita
Chief, Environmental Planning Section

Enclosure(s)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ARCATA FISH AND WILDLIFE OFFICE
1125 16TH STREET, ROOM 209
ARCATA, CA 95521
(707) 822-7201
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In Reply Refer To:
1-14-1998-150b

July 15, 1999

Peter E. LaCivita
Chief, Environmental Planning Section
Department of the Army
San Francisco District, Corps of Engineers
333 Market St., 7th Floor
San Francisco, California 94105-2197

Subject: Crescent City Harbor Federal Channel Extension and Deepening Project

Dear Mr. LaCivita:

This letter responds to your correspondence of July 1, 1998 (received by the Arcata Fish and Wildlife Office (AFWO) on July 20, 1998) requesting concurrence from the U.S. Fish and Wildlife Service (Service) with your determination that the proposed project, Crescent City Harbor Federal Channel Extension and Deepening Project, Del Norte County, California, would have no effect on any listed or proposed species in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act). This document transmits the Service's findings regarding your determination of effects.

The Army Corps of Engineers (Corp) requested the Service's concurrence with the Corp's determination that the projects would have no effect on the American peregrine falcon (*Falco peregrinus anatum*), marbled murrelet (*Brachyramphus marmoratus*), bald eagle (*Haliaeetus leucocephalus*), Aleutian Canada goose (*Branta canadensis leucoparaeia*), northern spotted owl (*Strix occidentalis caurina*), western snowy plover (*Charadrius alexandrinus nivosus*), tidewater goby (*Eucyclogobius newberryi*), Oregon silverspot butterfly (*Speyeria zerene hippoltya*), and western lily (*Lilium occidentale*). In addition, the coho salmon (*Oncorhynchus kisutch*) is addressed in the EA, but is a species under the regulatory jurisdiction of the National Marine Fisheries Service. Also, potential effects on the Wolf's evening primrose (*Oenothera wolfii*), a candidate species, was addressed in the EA, as well as several Species of Concern.

The Service reviewed the most recent biological assessment prepared by the Corps (dated May 1999). This consultation is also based upon conversations between Eric Joliffe, Tamara Terry and Peter LaCivita of the Corp and Ray Bosch of AFWO. A complete administrative record of this consultation is on file in this office.

Consultation History

The consultation history on this project has includes a series of correspondences resulting from changes to the proposed action. The changes to this project were identified in a series of Environmental/Biological Assessments (EA). The history of consultation on this project is as follows:

On May 21, 1998, the AFWO sent a species list to the Corp for their consideration during the preparation of the EA.

On July 1, 1998, the Corp sent to the Sacramento Fish and Wildlife Office (SFWO) (received July 8, 1998) the *Draft Environmental Assessment, Biological Assessment and Consistency Determination, Crescent City Harbor Federal Channel Extension and Deepening General Re-evaluation Report, Crescent City Harbor, Del Norte County, California*. The Corp requested written concurrence from the Service that no listed or proposed species would be affected by the proposed project. Subsequently, SFWO forwarded this document to AFWO, as AFWO had recently acquired jurisdiction within the Service for the project area on the north coast. The AFWO received that document on July 20, 1998.

On July 2, 1998, the Corp transmitted to the AFWO (received July 6, 1998) the *Draft Environmental Assessment For Fiscal Year (FY) 1998 Operations and Maintenance Dredging of the Crescent City Harbor Federal Channels, Del Norte County, California* (dated June 1998). The Corps requested that the Service provide written comments on the draft EA within 30 days.

On August 3, 1998, the AFWO responded to the Corp's request for a written response. The Service indicated that its comments pertained to both projects covered under the two Environmental Assessments that had been submitted, because the two projects, as then proposed, were closely associated and were likely to have similar effects on listed species. The Service did not concur with the Corp's "no effect" determinations for the listed species, and requested additional information about potential effects on several of the species in the project area.

On September 30, 1998, the Corp provided written response (received October 2, 1998) to the Service's request for clarification and additional information regarding effects on listed species.

Also on October 2, 1998, the AFWO received a copy of the *Final Environmental Assessment for Fiscal Year (FY) 1998 Operations and Maintenance Dredging of the Crescent City Harbor Federal Channels, Del Norte County, California* (dated August 1998).

On April 12, 1999, Eric Joliffe (Corps staff) sent to Ray Bosch (AFWO staff) a copy of the *Crescent City Harbor General Reevaluation Report For Navigation Improvements, Del Norte County, California* (dated March 4, 1999). At that time, Mr. Joliffe indicated that the Corp changed the project to include only upland disposal, and was modifying the upland disposal site to handle additional volume of disposal materials.

On June 24, 1999, Eric Joliffe transmitted a copy of the most recent draft of the *Environmental Assessment, Biological Assessment and Consistency Determination for the Crescent City Harbor*

Federal Channel Extension and Deepening General Re-Evaluation Report, Crescent City Harbor, Del Norte County, California, dated May 1999. This document indicates the changes that the Corp has incorporated into the final project description upon which this consultation is based, and the expected extent of impacts to listed species.

Description of the Proposed Action

The proposed structural alternative is to dredge an approximately 1,200-foot long access channel from the federal Inner Harbor Channel to the entrance of the Small Boat Basin in the harbor of Crescent City, Del Norte County, California. Channel bottom width would range from 140 feet to 210 feet, where it would flare to meet the Inner Harbor Channel. This flare is designed to facilitate the navigation through the turn from the Inner Harbor Channel. The turn and entrance into the Small Boat Basin would be as wide as the existing boat basin levees would permit. The channel side slopes would be excavated with a one foot vertical to three foot horizontal ratio. The non-Federal portion of the project consists of deepening the area between the proposed Federal Channel and the northwest side of Citizen's Dock.

This channel design would provide a minimum two-way traffic plan in the access channel, which is the minimum acceptable channel configuration, and most closely resembles the current channel operation.

Economic optimization resulted in a design depth of minus14 feet mean lower low water (MLLW) plus one foot of advanced maintenance and a one-foot overdepth allowance. The actual dredging method is anticipated to be a hydraulic operation. Dredge material would mostly be sandy with small amounts of broken rock (less than 10%). Some shale and graywacke may be encountered in the deeper portion of the channel, and a cutter-head dredge may be required. Approximately 37,670 cubic yards of material would be dredged. The dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site.

Maintenance dredging of the access channel would be performed on a five year cycle and would remove an average of 16,000 cubic yards of dredged material per cycle. Two existing federal channels would be combined into one proposed project in one maintenance operation, producing an estimated average quantity of 66,000 cy of O&M dredged material every five years. The anticipated disposal site for maintenance dredged material is SF-1 which would first require designation by the U.S. Environmental Protection Agency as an ocean disposal site under Section 102 of the Marine Protection Research and Sanctuaries Act of 1972 (MPRSA). Limited quantities of maintenance dredged material deemed acceptable for beach nourishment could be placed at Whaler Island.

Status of the Species and Effects of the Proposed Action

Actions similar to the proposed action have the potential to result in impacts to listed species through habitat removal and/or disturbance effects. Habitat removal could occur from deposition of dredged material at the upland disposal site, or from turbidity emanating from the dredge site. Disturbance effects could occur to some species temporarily displaced by the noise levels and human presence associated with dredging and disposal activities, above those levels of

disturbance currently found in the harbor area, especially if conducted during the breeding season.

In general, wildlife species can be adversely affected if behaviors associated with breeding, feeding or sheltering are modified due to human activities. For example, species temporarily displaced from normal roosting or foraging habitat could be considered to have been adversely affected by the activity causing the displacement. In cases where this displacement or behavioral modification is particularly acute (e.g., modifying behaviors associated with nest attendance), the effect could be significant and could reach the level of incidental take.

We have considered these potential sources of adverse effects to the listed species covered by your biological assessment. This consideration includes the information provided in the EA, and discussions with Corp personnel and other species experts.

Based on this information, the Service concurs with the Corp's determination that the proposed project, as described, will have no effect on the American peregrine falcon, bald eagle, Aleutian Canada goose, northern spotted owl, western snowy plover, tidewater goby, Oregon silverspot butterfly, western lily, and the Wolf's evening primrose. This concurrence is based on the following factors.

The peregrine falcon has no known nest sites within 2 miles of the proposed project, and the proposed project is not likely to have any affect on prey species' abundance or distribution, or on falcons foraging sites. The bald eagle has no known nest sites near the project, and is not expected to occur to occur at or near the construction site except as an occasional transient. The Aleutian Canada goose does not regularly roost or feed in or near the harbor site, staying mostly north of the project site on Castle Rock or near Lake Earl Wildlife Area and nearby farmlands. The northern spotted owl is a late-successional forest associated species; no suitable habitat occurs at or near the project site. The western snowy plover occurs on the north coast as an uncommon to rare nester and winter migrant. However, the species occurs mostly on wide open beaches, salt flats and occasional gravel bars. The species has been known to nest on dredge spoils (especially near Coos Bay, Oregon). However, the dredge spoils associated with the upland disposal site at Crescent City are much smaller in size, are not directly associated with ocean beaches, and are subject to significant disturbance from industrial development and recreational uses. The snowy plover is not expected to occur on these dredge spoils. The tidewater goby may occur in Elk Creek slough or lower stream reaches. The species is limited to estuarine habitats, where it nests in soft muds and sands in generally less that 1 m deep water. Although some sedimentation could occur as a result of hydraulic dredging, the project is expected to have no effect on gobies due to the distance from the potential source of sedimentation (0.5 mile) and the fact that goby habitat is likely to occur slightly upstream from any sediment deposition zone in Elk Creek slough above tidal influence. No suitable habitat for Oregon silverspot butterfly or its host species, *Viola adunca*, is known to occur on the project area.

The project is expected to have no effect on the western lily or Wolf's evening primrose, based on information provided in the EA. That assessment states that populations of these species do not occur on the disposal site, but acknowledges that these species do occur within the general

vicinity of Crescent City. The Corp will conduct additional surveys for these species on the upland disposal site. Should either of these species be found during the surveys, the Corp would reinitiate consultation with the Service and jointly develop appropriate conservation measures.

The marbled murrelet is a seabird that has adapted its nesting behavior to use large mature and old growth trees to nest in. Since no habitat of this type occurs near the project site, no effect to nesting habitat or behavior is anticipated. The species roosts and forages in near-shore marine waters, and could roost on the water or forage within the area of project influence. Since the species could be temporarily displaced from normal foraging or roosting sites, the Service does not concur with the Corp's determination that the project will have no effect on this species. However, since the likelihood of displacement of the species is low, the project duration is only several days, and the species is mobile, it likely that the level of risk of impacts to the species is insignificant. Therefore, the Service concludes that the project, as proposed, may affect, but is not likely to adversely affect, the marbled murrelet. In reaching this finding, the Service has not prescribed additional conservation measures or project modifications for the Corp to implement.

This consultation addresses only the American peregrine falcon, marbled murrelet, bald eagle, Aleutian Canada goose, northern spotted owl, western snowy plover, tidewater goby, Oregon silverspot butterfly , and western lily, and the Wolf's evening primrose. The Corps did not request consultation on other listed species in regards to this project. Also note that the anadromous fish species addressed under your EA are under the section 7 regulatory jurisdiction of the National Marine Fisheries Service.

No incidental take was requested for the proposed project, and none is authorized with this consultation. This concludes the informal consultation process. Unless new information reveals that the proposed action may affect listed species or critical habitat in a manner or to an extent not considered in your correspondence, the action is modified in a manner that causes an effect to the listed species or critical habitat not considered in your correspondence, or a new species or critical habitat is designated that may be affected by the proposed activity, no further action pursuant to the Act is necessary.

The Service thanks the Corp for their efforts to conserve listed species. If you have questions or concerns please contact Ray Bosch or David Solis of my staff (707 822-7201).

Sincerely,

Bruce Halstead

Bruce Halstead
Project Leader

cc:
NMFS, ATTN: D. Butler, Santa Rosa, California
FWS, ATTN: R. Brown, Arcata, California
FWS, ATTN: W. Amy, Sacramento, California

APPENDIX C
OTHER CORRESPONDENCE

Peter M. Rooney
Secretary for Environmental Protection

California Regional Water Quality Control Board

North Coast Region

Ross R. Liscum, Chairman

Internet Address: http://www.swrcb.ca.gov
5550 Skylane Boulevard, Suite A, Santa Rosa, California 95403
Phone (707) 576-2220 • FAX (707) 523-0135

Pete Wilson
Governor

September 15, 1998

Mr. Thomas R. Kendall
Acting Chief, Planning/Engineering Division
San Francisco District, Corps of Engineers
333 Market Street
San Francisco, CA 94105-2197

Dear Mr. Kendall:

Subject: Crescent City Harbor Federal Channels O&M Dredging Project - FY 1998

We have reviewed the draft Environmental Assessment (EA) for fiscal year 1998 operations and maintenance dredging of the Crescent City Harbor and your request for Water Quality Certification. The Regional Water Board adopted Order No. 92-103 which regulates maintenance dredging within the harbor. The work activities described by the EA will dredge the Inner Harbor Basin Channel and the Entrance Channel. It is our understanding that the entrance channel dredge material will be placed at the Harbor Districts Whaler Island Disposal Site for indirect beach nourishment of South Beach. The inner harbor channel materials will be placed in the Harbor Districts upland disposal ponds. Both of these areas are regulated by Order No. 92-103. Water Quality Certification is not required where a specific order is in place.

We look forward to working with the Harbor District and the Corps of Engineers on this project. Please call me at (707) 576-2683 if you have any questions.

Sincerely,

William T. Rodriguez
Sanitary Engineering Associate

WTR:tab/coecchb

cc: Crescent City Harbor District, 101 Citizens Dock Road, Crescent City, CA 95531

STATE OF CALIFORNIA – THE RESOURCES AGENCY

PETE WILSON, Govern

CALIFORNIA COASTAL COMMISSION
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200

September 11, 1998

Eric Joliffe
Planning Division
U.S. Army Corps of Engineers
San Francisco District
333 Market Street
San Francisco, CA 94105-2197

RE: **CD-81-98,** Army Corps, Access Channel Dredging, Crescent City, Del Norte County

Dear Mr. Joliffe:

On September 10, 1998, by a vote of 11 in favor, none opposed, the California Coastal Commission concurred with the above-referenced consistency determination. The Commission found the project to be consistent to the maximum extent practicable with the California Coastal Management Program.

Sincerely,

Mark Delaplaine

Mark Delaplaine
Federal Consistency Supervisor

cc: North Coast Area Office
NOAA Assistant Administrator
OCRM
Department of Water Resources
Governor's Washington D.C. Office
Jim Raives

CALIFORNIA COASTAL COMMISSION
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200

Th 5c

STAFF RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-81-98**
Staff:	MPD-SF
File Date:	7/7/1998
45th Day:	8/21/1998
60th Day:	9/5/1998
Extended to:	9/12/1998
Commission Meeting:	9/10/1998

FEDERAL AGENCY: **U.S. Army Corps of Engineers**

DEVELOPMENT LOCATION: Crescent City Harbor, Del Norte County (Exhibits 1-3)

DEVELOPMENT DESCRIPTION: Federal Channel Extension Dredging Project, consisting of dredging 19,400 cu. yds. of material along a 1,200 ft. long channel between the Small Boat Basin and the Federal Inner Harbor Channel, with disposal at the Crescent City Harbor District's upland site northwest of the small boat basin (Exhibits 1-4)

SUBSTANTIVE FILE DOCUMENTS: See Page 7

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (Corps) has submitted a consistency determination for the dredging of 19,400 cu. yds. of material in the access channel between the Small Boat Basin and the Federal Inner Harbor Channel in Crescent City Harbor. The material would be disposed of at the Crescent City Harbor District's upland site northwest of the small boat basin. The Commission recently concurred with disposal at this same site for material from the Corps' Inner Harbor channel dredging (part of CD-80-98). Like the Inner Harbor material, the access channel material is not suitable for beach replenishment and no designated ocean site is available. The Corps therefore has no alternative to disposal at the upland site. The project is consistent with the dredging, marine resources, and public access and recreation policies of the Coastal Act.

STAFF SUMMARY AND RECOMMENDATION

I. Project Description. The Corps proposes to dredge 19,400 cu. yds. of material in the access channel between the Small Boat Basin and the Federal Inner Harbor Channel in Crescent City Harbor.. The material would be disposed of at the Crescent City Harbor District's upland site northwest of the Small Boat Basin. The access channel would be dredged to -14 ft. mean lower low water (MLLW), with a two ft. overdredge allowance (Exhibit 4). The Corps would use a hydraulic dredger, and the material would be transported to the upland site by pipeline. The dredging would take 4-5 days and is scheduled for winter 1998/1999.

The project is needed to eliminate tidal delays, accommodate larger vessels, and increase the efficiency of the harbor. The Harbor District is unable to adequately maintain needed depths in the access channel, as the rate of shoaling exceeds the ability of the District's dredge plant to keep the channel open. While the Corps has historically dredged the federal channels at Crescent City, the Corps has not previously maintained the access channel to the Small Boat Basin.

II. Crescent City Dredging History. At the August Commission meeting the Commission reviewed the Corps' proposal for 82,000 cu. yds. of maintenance dredging of the Inner and Entrance channels (CD-80-98). As the project was modified at the hearing, the Commission concurred with disposal of 65,000 cu. yds. of Entrance Channel material at Whaler Island (i.e., beach replenishment) and 17,000 cu. yds. of Inner Channel material at the Harbor District's upland site (assuming the upland site has available capacity; if not the inner channel would not be dredged). The Corps had initially proposed disposal of all the material at Whaler Island. However once the test results showed the Inner channel material to be unsuitable for beach replenishment, the Corps revised the proposal.

In prior years, for most past Corps dredging operations in Crescent City Harbor, the Corps used SF-1, which is an offshore site outside the littoral cell (Exhibit 1). Aside from the August Commission decision, previous Commission actions on Corps Consistency and Negative Determinations for Maintenance Dredging in Crescent City include the following:

(1) Commission concurrence with CD-19-81, a consistency determination for 138,000 cu. yds. of dredging, with disposal at SF-1.

(2) Commission staff objection to CD 28-88, a negative determination for 70,000 cu. yds. of dredging, with disposal at SF-1. The basis for the objection was because the sediment test results were not available. (This project was resubmitted as CD-43-88.)

(3) Commission staff concurrence with CD-43-88, a negative determination for the same 70,000 cu. yds. of dredging, with disposal at SF-1. This submittal now included the test results. In addition, because of a large quantity of organic material in the sediment the Commission staff agreed that beach replenishment was inappropriate.

(4) Commission staff concurrence with ND-71-93, a negative determination for 40,000 cu. yds. of dredging, with disposal at SF-1.

In addition, the Crescent City Harbor District has historically dredged the inner channels, including in at least one instance disposal at the proposed Whaler Island site. In 1988 the Commission approved a permit with conditions to the Harbor District (CDP 1-88-115), which authorized a 10-year dredging and disposal operation for up to 75,000 cu. yds./year. That permit expired this year, and the Harbor District recently applied for and received an extension to the permit.

III. **Status of Local Coastal Program**. The standard of review for federal consistency determinations is the policies of Chapter 3 of the Coastal Act, and not the Local Coastal Program (LCP) of the affected area. If the LCP has been certified by the Commission and incorporated into the CCMP, it can provide guidance in applying Chapter 3 policies in light of local circumstances. If the LCP has not been incorporated into the CCMP, it cannot be used to guide the Commission's decision, but it can be used as background information. The Crescent City LCP has been certified by the Commission and incorporated into the CCMP.

IV. **Federal Agency's Consistency Determination**. The Corps of Engineers has determined the project consistent to the maximum extent practicable with the California Coastal Management Program.

V. **Staff Recommendation.**

The staff recommends that the Commission adopt the following motion:

MOTION. I move that the Commission **concur** with the Corps of Engineers' consistency determination.

The staff recommends a **YES** vote on this motion. A majority vote in the affirmative will result in adoption of the following resolution:

Concurrence

The Commission hereby **concurs** with the consistency determination made by the Corps of Engineers for the proposed project, finding that the project is consistent to the maximum extent practicable with the California Coastal Management Program (CCMP).

VI. Findings and Declarations:

The Commission finds and declares as follows:

A. Need for Dredging/Navigation. Maintenance dredging of existing navigation channels in Crescent City Harbor supports the dredging needs of the Crescent City Harbor District, the Coast Guard, and commercial fishing and recreational boats using the harbor. The Coastal Act contains strong policy language and legislative direction supporting and encouraging protection of existing shipping and boating uses, including commercial and recreational fishing activities. Section 30220 provides that:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

Section 30224 provides that:

> *Increased recreational boating use of coastal waters shall be encouraged, in accordance with this division, by developing dry storage areas, increasing public launching facilities, providing additional berthing space in existing harbors, limiting non-water-dependent land uses that congest access corridors and preclude boating support facilities, providing harbors of refuge, and by providing for new boating facilities in natural harbors, new protected water areas, and in areas dredged from dry land.*

Section 30234 provides, in part:

> *Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded ....*

Section 30234.5 provides in part:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Maintenance of the channels within the harbor is necessary to provide access to berthing, unloading and loading, and repair areas. These channels need regular dredging in order to maintain the depth necessary for ingress and egress into the bay. The Coastal Act supports the proposed maintenance dredging in Crescent City Harbor, because it is necessary to accommodate high priority uses such as those identified in Sections 30220, 30224, 30234 and 30234.5 of the Coastal Act.

B. <u>Dredging and Marine Resources.</u> Section 30233(a) of the Coastal Act states in part that:

> *(a) The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following [, including]: ...*
>
> *(2) Maintaining existing, or restoring previously dredged, depths in existing navigational channels, turning basins, vessel berthing and mooring areas, and boat launching ramps. ...*

Section 30230 of the Coastal Act provides:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30231 provides, in part:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored ...*

Both of these sections mandate the protection of marine resources. In addition, Sections 30234 and 30234.5 of the Coastal Act, quoted on page 4 above, provide for the protection of commercial and recreational fishery resources.

The proposed maintenance dredging constitutes dredging and filling within coastal waters. Section 30233(a) of the Coastal Act sets up a three part test for such projects: (1) an allowable use test; (2) an alternatives test; and (3) a mitigation test. The first test is met because the project qualifies as an allowable use under Section 30233(a)(2) as "Maintaining existing, ... previously dredged, depths in existing navigational channels ...".

Addressing the second (alternatives) test of Section 30233(a), without the dredging navigation in the harbor would become hazardous and eventually impassable due to sedimentation. No other dredging alternatives are feasible or less damaging. As it has

determined previously, the Commission finds that the proposed maintenance dredging of existing navigation channels in Crescent City Harbor to previously dredged depths represents the least damaging feasible dredging alternative.

Turning next to disposal alternatives, the Corps considered: (1) the historically used SF-1 site; (2) beach replenishment at the Whaler Island site proposed as part of the Corps project reviewed last month in CD-80-98; (3) development of an anchorage area within the outer harbor area; (4) the "no-project" alternative; and (5) the proposed upland disposal site.

The SF-1 site, located approximately 1.25 miles southwest of the harbor (Exhibit 1), was a historically available site. However the site's availability as an approved disposal site under the Marine Protection Research and Sanctuaries Act of 1972 (MPRSA) lapsed on January 1, 1997; therefore this site is not usable under Section 102 of the MPRSA. It could be used under Section 103 of the MPRSA; however the Corps has not prepared the necessary analysis that would need to accompany an application for a "103" disposal request. Therefore this site is not a feasible alternative at this time.

The Whaler Island site would only be appropriate if the material were suitable for beach replenishment. The Corps' sediment size analysis (based on 1996 data) indicates that the sand content ranges from 40-70% sand (and with some samples showing high organic carbon content), which renders it too silty for beach replenishment disposal at Whaler Island. Therefore Whaler Island disposal is not appropriate given the currently available test results. The outer anchorage alternative was rejected as infeasible due to safety reasons. The no project alternative was rejected because, as stated in the previous section of this report, not dredging the harbor would conflict with Coastal Act goals supporting boating, fishing, and other high priority uses. The Commission therefore finds that the proposed upland disposal at the Harbor District's designated dredge disposal site represents the least environmentally damaging feasible disposal alternative, and that the project is consistent with the alternatives test of Section 30233(a).

Addressing the third (mitigation) test of Section 30233(a), the Commission finds that no mitigation is warranted for maintenance dredging with upland disposal. The Commission concludes that the project meets all the applicable tests of Section 30233(a) and the other applicable requirements of the marine resources, water quality, fisheries, and recreation sections (Sections 30230-30234.5) of the Coastal Act.

C. **Sand Supply**. Section 30233(b) of the Coastal Act provides:

(b) Dredging and spoils disposal shall be planned and carried out to avoid significant disruption to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be transported for such purposes to appropriate beaches or into suitable long shore current systems.

This section of the Coastal Act encourages placement of sandy dredge spoils in a manner that will ensure their return to the longshore transport system, when possible. One of the concerns of any dredging project and spoils disposal is the loss of sand to the particular littoral cell, and the possible resulting erosion up- or down-coast. The Commission has expressed concerns over past Corps disposal at SF-1 because it removes material from the littoral system. The Commission has in fact encouraged consideration of beach replenishment for Crescent City dredging, where appropriate. At the last Commission meeting in reviewing CD-80-98 the Commission concurred with the Corps' proposal to dispose of sandy Entrance Channel material at Whaler Island (the remainder of the material, the Inner channel material, was not suitable for beach nourishment). However, in this case the Corps' test results (based on 1996 data) indicate the material contains too little sand (40-70% sand), and in some instances containing too much total organic carbon, to be suitable for beach nourishment. The Commission would consider beach replenishment if the Corps could provide current data indicating the material's suitability for beach replenishment. However, given the currently available data, the Commission finds that the material is not suitable for beach replenishment and that the proposed upland disposal is consistent with the sand supply policy Section (30233(b)) of the Coastal Act.

VII. SUBSTANTIVE FILE DOCUMENTS

1. Previous Corps Consistency and Negative Determinations for Maintenance Dredging in Crescent City - CD-80-98, ND-71-93, CD-43-88, ND 28-88, CD-19-81.

2. Crescent City Harbor Del Norte County, CA, General Investigation Study, Draft Environmental Assessment With Biological Assessment and Consistency Determination.

3. Crescent City Harbor District Dredging Permits 1-88-115 and NCR-76-C-282.

4. Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual, Environmental Protection Agency and the Corps of Engineers, February, 1991.

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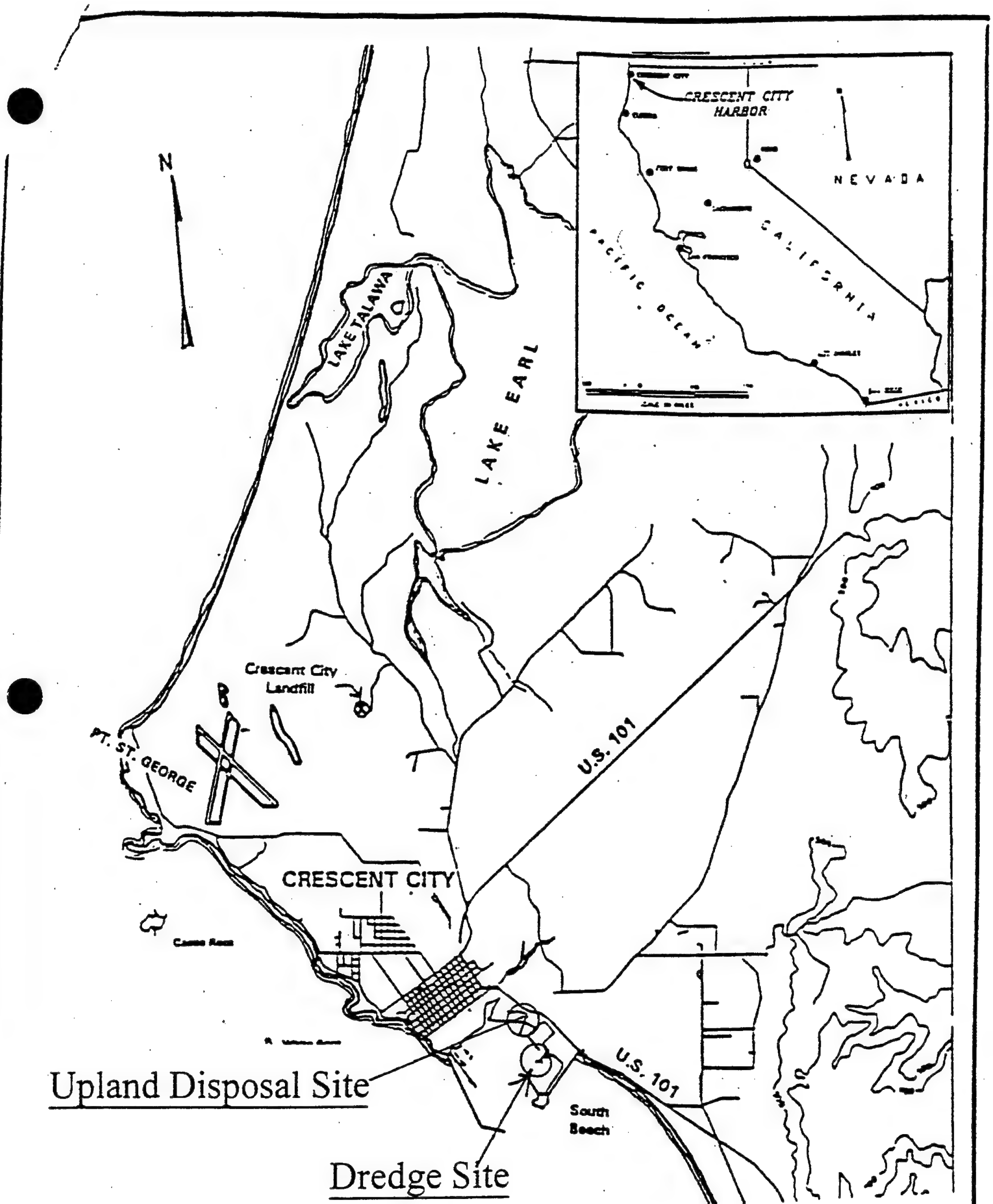

SF-1
DREDGED MATERIAL
DISPOSAL SITE

DEL NORTE CO	CALIFORNIA
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	APPLICATION NO.
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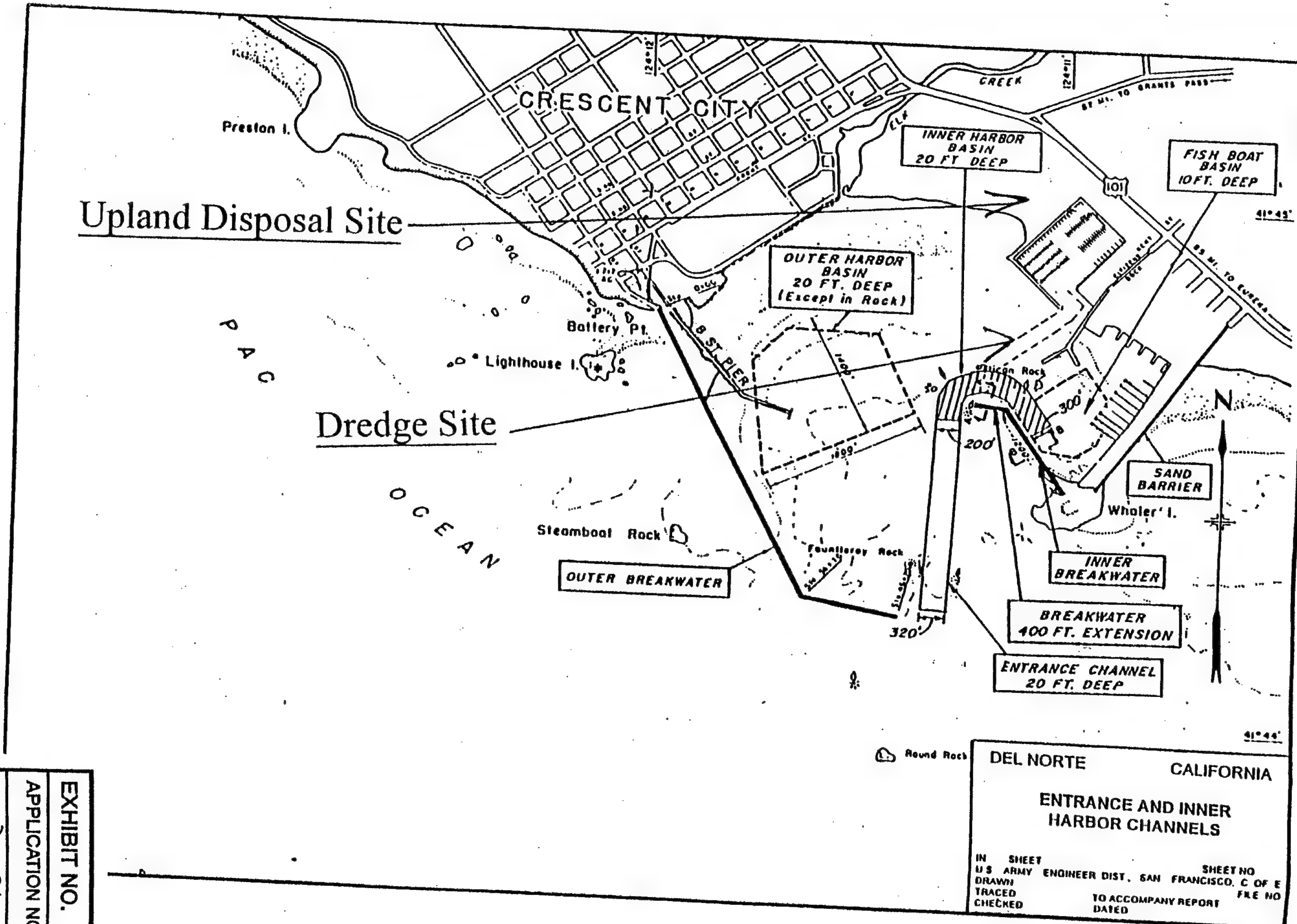

FIGURE 2.

EXHIBIT NO. 2
APPLICATION NO.
CD-81-98

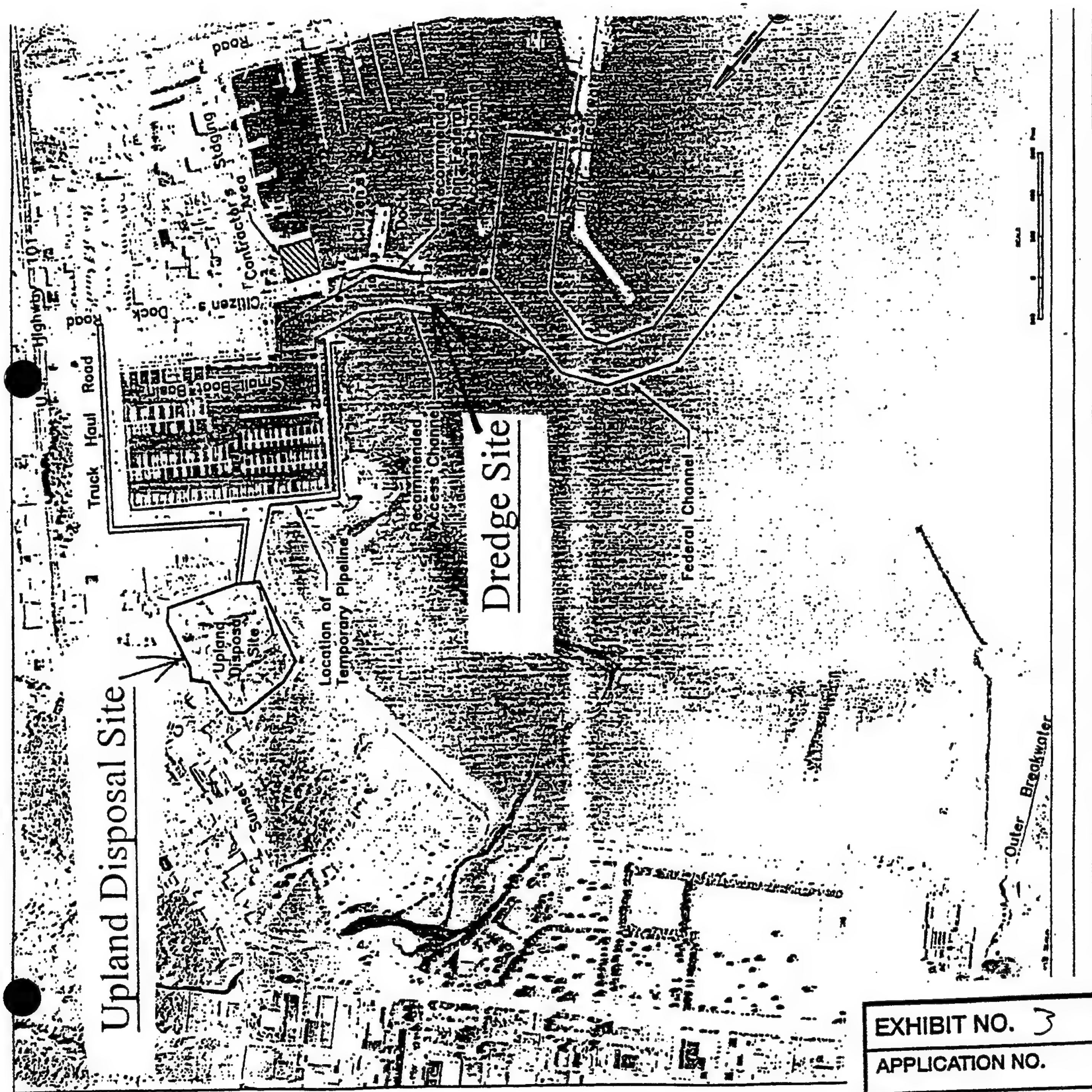

EXHIBIT NO. 3

APPLICATION NO.

CD-81-98

APPENDIX D

FISH AND WILDLIFE COORDINATION ACT REPORT

UNITED STATES DEPARTMENT of the INTERIOR

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE COORDINATION ACT REPORT

FOR THE

CRESCENT CITY HARBOR CHANNEL IMPROVEMENT PROJECT

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

PREPARED BY

U.S. FISH AND WILDLIFE SERVICE
SACRAMENTO, CALIFORNIA

JULY 1999

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

IN REPLY REFER TO:
HC-CE

July 28, 1999

District Engineer
Corps of Engineers, San Francisco District
333 Market Street
San Francisco, California 94105-2197

Subject: CESF - Crescent City Harbor Channel Improvement Project, Del Norte County, California

Dear Lt. Colonel Grass:

Enclosed is the Fish and Wildlife Service's Fish and Wildlife Coordination Act report for the Crescent City Harbor Channel Improvement Project. This document addresses the impacts that would occur at the Small Boat Basin Access Channel from deepening, and at the proposed dredged material disposal sites (upland and open ocean disposal sites). It describes the fish and wildlife resources found at these sites, and the impacts that improvements of the present harbor channel may have on these resources. Recommendations are based on compensation commensurate with the fish and wildlife values involved.

Impacts were analyzed from dredging the Small Boat Basin Access Channel, and disposing of the material at either the Open Ocean Disposal Site or the Upland Disposal Site. Habitat Evaluation Procedures (HEP) were used to analyze impacts at the Upland Disposal Site, and a HEP-like habitat-based assessment was used to analyze impacts at the Small Boat Basin Access Channel and Open Ocean Disposal Site. However, review of sediment tests show levels of Nickel and Cromium are currently above acceptable levels for ocean disposal.

This report has been coordinated with the California Department of Fish and Game and the National Marine Fisheries Service. Their letters of review and concurrence are found in Appendix E of the enclosed report.

Should you have any questions concerning this report, please contact Doug Weinrich of my staff at (916) 414-6600.

Sincerely,

Dale A. Pierce

for Wayne S. White
Field Supervisor

Enclosure

cc: AES-Portland, OR
FWS, Arcata, CA (Attn: Ray Bosch)
CESF (Attn: Eric Joliffe)
NMFS, Santa Rosa, CA
CDFG, Director, Sacramento
CDFG, Menlo Park (Attn: Robert Tasto)
CDFG, Eureka (Attn: Karen Kovacs, Ron Warner)

EXECUTIVE SUMMARY

The purpose of the Crescent City Harbor project is to provide navigation improvements in the Citizens Dock and Small Boat Basin Access Channel (Access Channel) in the Crescent City Harbor, Del Norte County, California. The major cause of navigation delay to and from the Citizen's Dock and the Small Boat Basin is that the Access Channel is at an inadequate depth for safe, unrestricted navigation. The access channel is currently maintenance-dredged by the Crescent City Harbor District, however, limited maintenance capabilities combined with periodic episodes of rapid shoaling in the access channel have not permitted efficient use of the harbor facilities. The Board of Harbor Commissioners of the Harbor District requested that the Corps of Engineers (Corps) conduct a Reconnaissance Study to determine the Federal interest in deepening and maintaining the currently non-Federal access channel.

The Access Channel would be dredged and the material disposed of at an Upland Disposal Site. Future maintenance dredging would be disposed at an Open Ocean Disposal Site, although the Open Ocean Disposal Site has not been designated as a permanent disposal site by the U.S. Environmental Protection Agency. The initial amount of dredged material is estimated to be about 26,020 cubic yards (cys) and maintenance dredging of about 16,000 cys biennially. Maintenance dredging is not expected to occur for the first 5 years of the project. The Upland Disposal Site is located adjacent to the Crescent City Harbor Boat Basin and is owned and operated by the Crescent City Harbor District, which is the local sponsor for the project. The Open Ocean Disposal Site is located about 1.3 miles southwest of Crescent City Harbor and has been used for maintenance dredging disposal in the past.

Habitat Evaluation Procedures (HEP) is a methodology developed by the Fish and Wildlife Service (Service) and other resource and water development agencies for documenting the quality and quantity of available habitat for selected fish and wildlife species. The fish and wildlife impact evaluations for the project were conducted using a combination of HEP (for the proposed Upland Disposal Site) and a HEP-like habitat-based assessment using word models initially developed for the Oakland and Richmond Harbor Navigation Projects, and modified for the Crescent City Harbor Project (for the access channel and Open Ocean Disposal sites).

Two HEPs were run for the Upland Disposal Site. The results of the first HEP indicate there would be no additional adverse impact when comparing the future with- and without-project conditions. Since there was no written assurance that the permit(s) required to continue use of this particular disposal site exist, a second scenario was run in the HEP to estimate what the adverse impacts of using this site in the future for dredged material disposal would be from this project or future project activities, if the site was not permitted when construction begins. In this scenario, the permitted use of the site was not renewed, but the initial dredging was completed prior to the expiration of the existing permit. The HEP was then rerun with an assumption that the site will develop improved upland habitat values once disposal activities on the site cease. The results of this second analysis indicate that the savannah sparrow and yellow warbler would have net losses of -2.97 and -3.87 Average Annual Habitat Units (AAHUs), respectively, over the life of the project if the site is used for disposal in the future. The current proposal is to use

the existing site for the disposal of initial dredged material and not move it to another site after drying. If this material were to be used in the future, impacts for loss of habitat values which establish on the site would be determined at that time.

For the Access Channel, we estimated a loss of -1.09 AAHUs of subtidal benthic habitat value would occur due to construction and maintenance, compared with existing conditions. At the same time, we expect a modest gain in water column habitat value of +0.69 AAHUs, a result which can be attributed to the use of a less dispersive dredging method. The calculated loss of habitat values are minimal and restricted to a very small area (about 6 acres). Accordingly, we do not recommend mitigation for impacts of construction of the access channel at this time.

For the deep ocean disposal site, we estimated a combined loss of -2.39 AAHUs (2.13 AAHUs of deepwater benthic value and 0.26 AAHUs of open surface water value) due to disposal of dredged materials from construction and maintenance of the access channel. These are considered very low losses in comparison with an estimate of 1,919 AAHUs for the much greater volume of disposal expected at the San Francisco Deep Ocean Disposal Site (SF-DODS), which could accept up to a combined 6 million cys per year of dredged material from an array of San Francisco Bay area channels. Therefore, assuming that (a) Crescent City Harbor is the sole source of material, (b) disposal does not exceed the volumes assumed in this analysis, and (c) USEPA "greenbook" testing shows no contaminants or toxicity, we do not recommend mitigation if the Open Ocean Disposal Site is selected as the disposal alternative for construction of an access channel at Crescent City Harbor.

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INTRODUCTION

This is our detailed Fish and Wildlife Coordination Act (FWCA) report on the effects that the U.S. Army Corps of Engineers' (Corps) Crescent City Harbor Channel Improvement Project would have on fish and wildlife resources. The purpose of the project is to provide navigation improvements in the Citizens Dock and Small Boat Basin Access Channel (Access Channel) in the Crescent City Harbor, Del Norte County, California (Figure 1). The major cause of navigation delay to and from the Citizen's Dock and the Small Boat Basin is that the Access Channel is at an inadequate depth for safe, unrestricted navigation. The proposed project would alleviate the problem through deepening and maintaining the Access Channel from the Inner Harbor Channel to the Citizen's Dock and the Small Boat Basin (USACE 1995). The dredged material would be disposed of at either an Upland Disposal Site or an Open Ocean Disposal Site, which currently has not been designated by the U.S. Environmental Protection Agency (USEPA) as a permanent disposal site.

This report has been prepared under authority of, and in accordance with, the provisions of the FWCA (48 Stat. 401 as amended; U.S.C. et seq.). This report supplements two previous Planning Aid Reports submitted by the Service in 1989 and 1995, a preliminary draft FWCA report submitted in May 1996, and a draft FWCA report submitted in July 1996. Our appraisal of resources is based on a literature review; our own in-house expertise; personal communication with other recognized experts; aerial photographs; and a field investigation conducted on March 27, 1996. Our analysis will not remain valid if the project, the resource base, or anticipated future conditions change significantly.

DESCRIPTION OF PROJECT

The ocean commercial fisheries industry is a major contributor to the economy of Crescent City, California. Currently, commercial fishing vessels experience navigational difficulties while gaining access to the Small Boat Basin in Crescent City Harbor due to shallow channel depths. Shoaling of the Access Channel forces boats to rely on tidal cycles to enter the Small Boat Basin. Additionally, problems occur as larger boats clog the entrance to the harbor, causing delays to all marine vessels, as they wait for the tides to come in (USACE 1994). The Access Channel is currently maintenance-dredged by the local Harbor District; however, limited maintenance capabilities combined with periodic episodes of rapid shoaling in the Access Channel have not permitted efficient use of the harbor facilities.

There are two existing federally-maintained navigation channels at Crescent City Harbor; the Entrance Channel and Inner Harbor Channel. The Entrance Channel begins at the outer breakwater and is 20 feet deep, 2,600 feet long, and 200 feet wide. This Entrance Channel connects to the Inner Harbor Channel which is 1,500 feet long and extends from the Entrance Channel along the lee side of the inner breakwater (Figure 2). The Inner Harbor Channel was originally authorized and historically maintained at -20 feet mean lower low water (MLLW) but this depth was reduced to -15 feet MLLW in 1993 due to lack of economic justification for continued dredging to the authorized depth (USACE 1996).

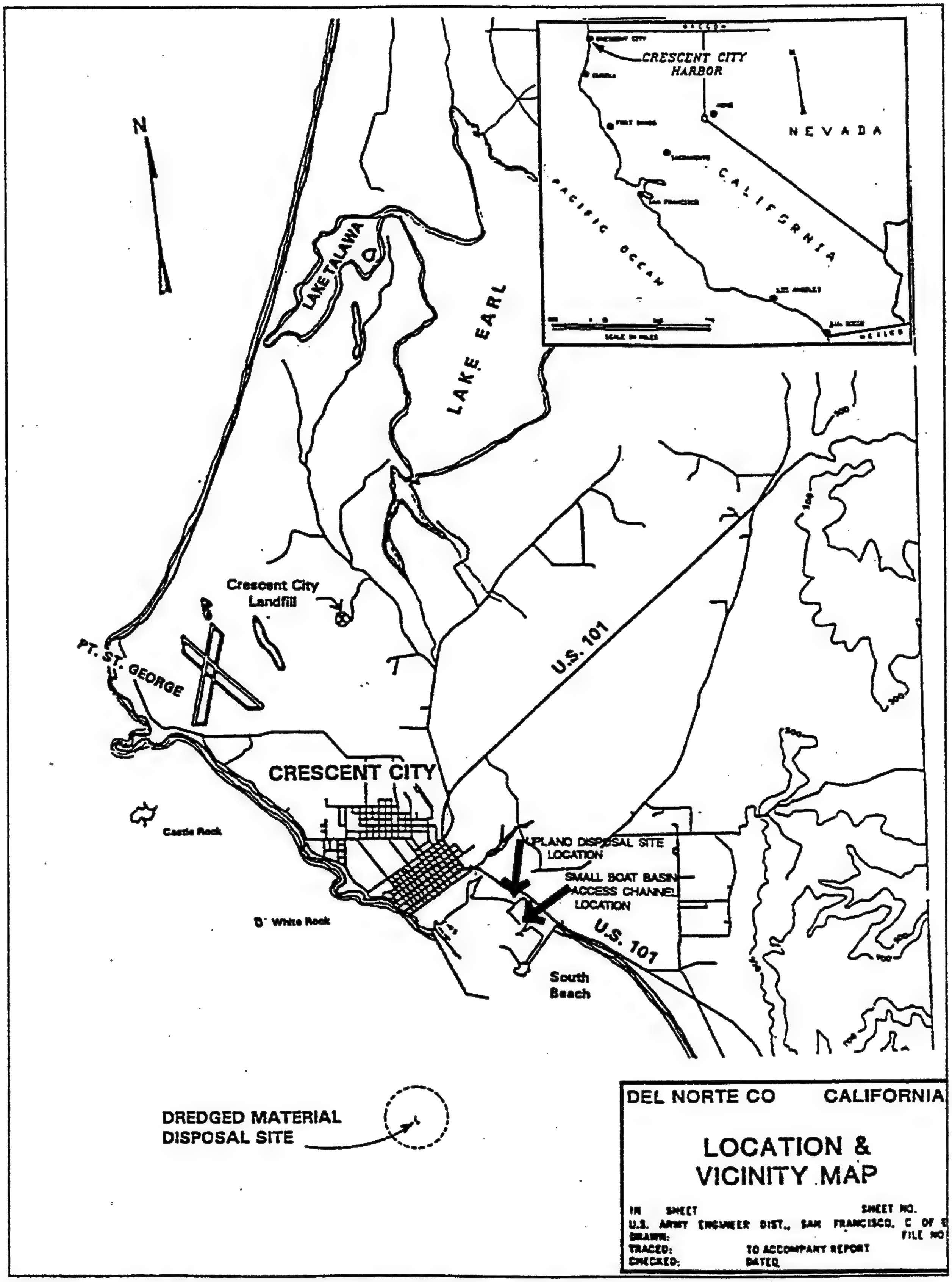

Figure 1. Location and vicinity map for the Crescent City Harbor Project.

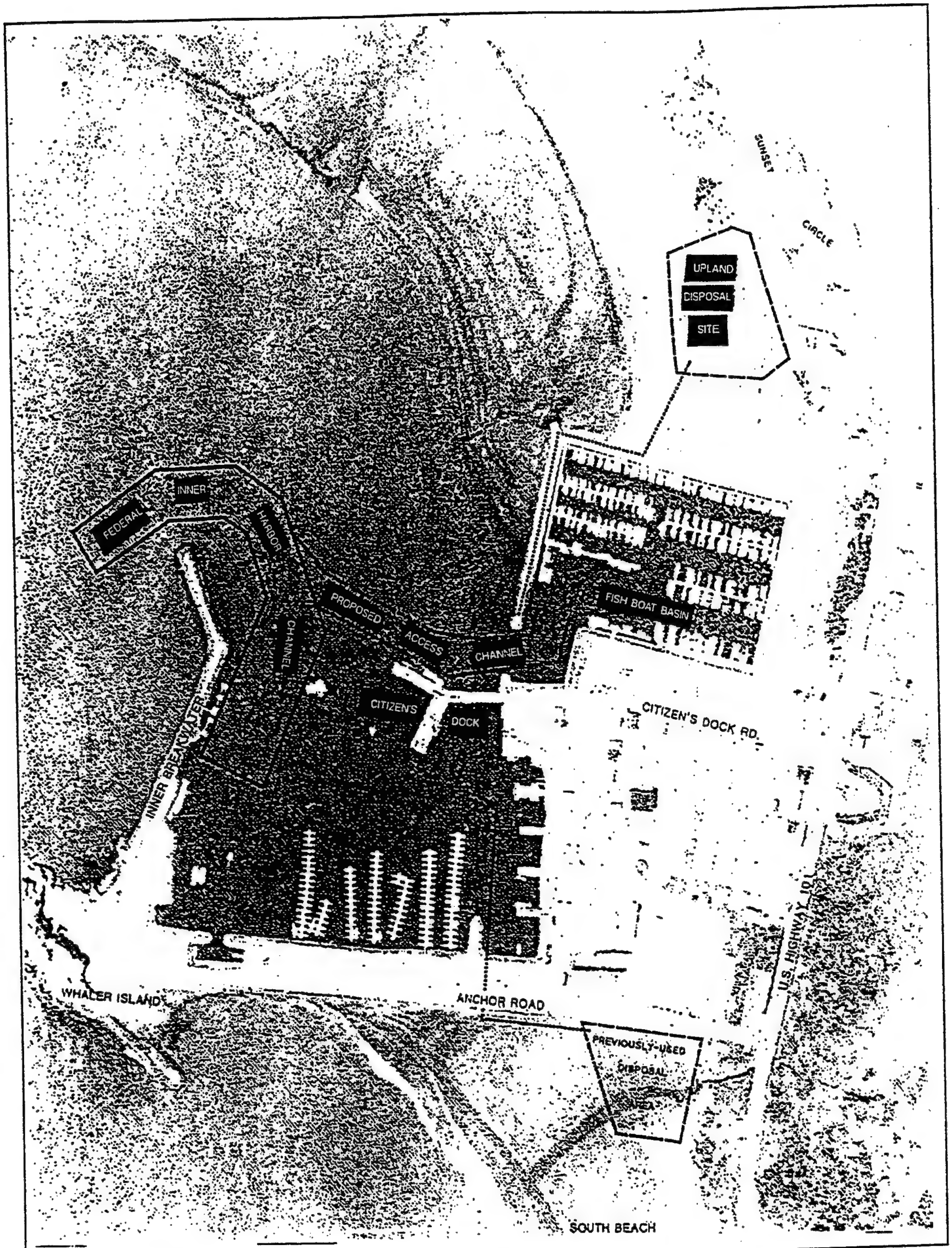

Figure 2. Location of project features for the Crescent City Harbor Project.

The Access Channel from the Inner Harbor Channel to the Citizen's Dock and the Small Boat Basin is not a Federal project. The Access Channel was initially dredged to -16 feet MLLW and about 150 feet wide for access to the Small Boat Basin. However, this channel has never been maintained to -16 feet MLLW and, consequently, has shoaled in significantly (USACE 1995). At this time, it is unknown how much material would need to be maintenance-dredged under with-the-project conditions.

The Board of Harbor Commissioners of the Crescent City Harbor District requested that the Corps conduct a Reconnaissance Study to determine the Federal interest in deepening and maintaining the currently non-Federal Access Channel. The objective of the Corps' Reconnaissance Study was to investigate extending the existing Federal channel from the Inner Harbor Channel to the Citizen's Dock and the Small Boat Basin. The project would be designed to reduce direct delays to larger vessels due to low tides, and to other fishing boats using the facilities at the Citizen's Dock caused by the berthing of large boats that cannot enter the Small Boat Basin. The project would deepen the existing channel and transfer the maintenance of the channel from the Harbor District to the Federal government (USACE 1995).

The Access Channel would be dredged and the material disposed of at the Upland Disposal Site or the Open Ocean Disposal Site. The Upland Disposal Site is located adjacent to the Crescent City Harbor Boat Basin. This site is owned and operated by the Crescent City Harbor District, which is the local sponsor for the project. The Open Ocean Disposal Site is located about 1.3 miles southwest of Crescent City Harbor and has been used for maintenance dredging disposal in the past. The Open Ocean Disposal Site has not been designated as a permanent disposal site by the USEPA.

DESCRIPTION OF AREA

A. General Area Description

Crescent City Harbor is a small commercial harbor located on the Northern California coast, about 280 miles north of San Francisco, and about 17 miles south of the Oregon border, that was formed by a natural coastal indentation. It is defined by a 4,700-foot-long rubble mound outer breakwater, which protects the harbor from storms out of the west, a 2,400-foot-long sand barrier, a 1,600-foot-long inner breakwater which protects it from storms out of the south, and by the general contours of the coastline to the northwest. The harbor lies adjacent to the Northern Coast and Klamath Mountain ranges and, measured along the shoreline, is about 1 mile long and faces south (USACE 1995).

The harbor contains a commercial berthing facility (the inner boat basin) and a 527-slip recreational moorage facility. The harbor also contains the Citizens Dock, two fish processing plants, a marine repair facility, a Coast Guard dock, and other commercial and recreational facilities. Traffic consists mainly of commercial and sport fishing vessels, with commercial fishing activities constituting about 90 percent of the total harbor commerce. Over 39 million pounds of fish and shellfish, valued at 16.7 million dollars, were landed at Crescent City in 1992 (USACE 1995).

The only surface drainage entering Crescent City Harbor is Elk Creek, which is located at the north end of the harbor. Its watershed covers about 3,091 acres and is composed of predominantly low-density suburban development and pasture lands (USACE 1994).

B. Small Boat Basin Access Channel

The Small Boat Basin was constructed by the Crescent City Harbor District in 1974. The Access Channel from the Inner Harbor Channel to the Citizen's Dock and Small Boat Basin is not a Federal project. In the past, the Harbor District performed limited maintenance dredging with their own dredge in the area, but their efforts have not adequately maintained the channel. The Harbor District has a Corps permit to dredge and maintain the harbor. However, while their permit allows them to dredge the Access Channel to -16 feet, they do not have the ability to deepen and maintain the Access Channel to this depth because of their limited dredge plant and the rapid shoaling rate. Based on an October 8, 1993 survey, portions of the Access Channel have shoaled to about -12 feet (USACE 1995).

C. Open Ocean Disposal Site

The Open Ocean Disposal Site is a USEPA designated interim disposal site known as SF #1. The site is located 1.3 miles offshore at 41° 43'15" North, 124° 12'10" West (Figure 2). The area of the site is about 0.2 square nautical miles and it occurs at a depth of 90 feet (MLLW). The Harbor District has used the site in the past for maintenance dredging disposal by obtaining a project-specific designation (Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1977) from the USEPA. This site designation expired in 1997, therefore, the USEPA has recommended studies for a Section 102 (of the above-mentioned Act) permanent site designation be conducted. Currently, the USEPA has not designated this site as a permanent disposal site.

D. Upland Disposal Site

The Crescent City Harbor District owns and operates the proposed Upland Disposal Site. It is located just north of the Small Boat Basin, and is about 7.1 acres in size. It was designated as a disposal site in 1987; no mitigation was done as a condition for site use (G. Smedley, pers. comm. 1996). The site is permitted to take up to 70,000 cys of dredged material on a yearly basis; currently, about 50,000 cys of dredged material are disposed at the site annually (Tremble, pers. comm. 1994). The upland disposal site in its present condition has a capacity of about 27,000 cys. The present levee elevations range from 14.3 feet to 17.8 feet MLLW. The minimum cost option for upgrading this site would be to increase the height of the levees by 2 to 3 feet using material from inside the site and limited offsite material. These improvements would have about the same footprint and area as the present site. With these improvements, the levees would have a uniform elevation of 19 feet MLLW to provide a capacity of 63,000 cys. No construction would take place in the wetland areas along the north and west sides of the disposal site (USACE 1999).

The permit, which allows the site use, expired in 1998. Currently, the permit for disposal at this site is being coordinated between the Harbor District and the water board. The Crescent City Landfill will not be used as the ultimate disposal site (E. Joliffe, pers. comm. 1999). It may also

be possible to use this upland disposal site for a considerable period of time for Operations and Maintenance work (USACE 1996).

DESCRIPTION OF ALTERNATIVES

A. Small Boat Basin Access Channel

The proposed Crescent City Harbor project consists of two alternatives: The No-action Alternative and one Structural Alternative. A description of these alternatives follows.

a. No-action Alternative

The No-Action Alternative assumes that the Federal government would not deepen and subsequently maintain the Access Channel, and that the Crescent City Harbor District would continue to maintain the channel to the best of their abilities. If no action were taken, the Access Channel would most likely remain at a depth which would continue to cause tidal-related navigation delays for boats using the existing Federal channel, Citizen's Dock, and Small Boat Basin (USACE 1995).

b. Structural Alternative

The proposed project would consist of dredging the Access Channel about 1,200 feet long (the distance between the existing Federal channel and the entrance to the Small Boat Basin) with a width of 140 feet, and flares to 210 feet at the Inner Harbor Channel junction and 180 feet at a bend near the Small Boat Basin entrance. The side slopes for the channel would be 3 horizontal to 1 vertical (3H:1V). Three dredging depths were evaluated in the HEP: 1) -15 feet MLLW with 2 feet of overdepth; 2) -14 feet MLLW with 1 foot of overdepth; and 3) -13 feet MLLW with 1 foot of overdepth (Table 1).

Table 1. Proposed design depths for the Crescent City Harbor Channel Improvement Project.

DESIGN DEPTH (FT)	ROCK EXCAVATION DEPTH (FT)	OVERDEPTH (FT)	TOTAL DEPTH (FT)
-15[1]	-1	-1	-17
-14	0	-1	-15
-13	0	-1	-14

[1]Corps's preferred design depth.

The preferred alternative is -14 feet MLLW with 1 foot overdepth and is what is analyzed in the HEP for the Access Channel (Appendix C). Rock is assumed to be present at -15 feet MLLW and below. The depths above are based on using a hydraulic dredge with cutter heads, connected by pipeline to the Harbor's Upland Disposal Site. (USACE 1996).

The amount of material to be dredged from the Access Channel is shown in Table 2. The material itself is expected to be mostly sandy with small amounts of broken rock (less than 10 percent). It is expected that the material will not be contaminated with metals or other toxics

(USACE 1994). The dredged material would be disposed of at the 1) Crescent City Harbor District's Upland Disposal Site, or 2) Open Ocean Disposal Site.

Table 2. Proposed quantities to be dredged from the Access Channel for the Crescent City Harbor Channel Improvement Project.

TOTAL DEPTH (FT)	FEDERAL PORTION			NON-FEDERAL PORTION			TOTAL CYS
	CHANNEL (CYS)	ROCK (CYS)	1 FOOT OVERDEPTH (CYS)	CHANNEL (CYS)	ROCK (CYS)	1 FOOT OVERDEPTH (CYS)	
-17	12,230	4,615	5,915	1,630	815	815	26,020
-15[1]	7,540	0	3,425	1,260	0	815	13,040
-14	2,340	0	1,730	330	0	670	5,070

[1]Corps' preferred alternative.

B. *Open Ocean Disposal Site*

This alternative consists of dredging the Access Channel with a clamshell dredge and disposing of it at the SF #1 offshore disposal site (USACE 1995). The USEPA and the Corps regulate ocean disposal of dredged material under the Marine Protection, Research, and Sanctuaries Act of 1972, also known as the Ocean Dumping Act. The primary purpose of this act is to regulate the dumping and transportation for dumping of waste materials in the ocean, so that "no unreasonable degradation or endangerment shall occur to human health, welfare or amenities of the marine environment, ecological system, or economic potentialities". The dredged material from the deepening project must be determined to be environmentally acceptable for ocean dumping at the Open Ocean Disposal Site based on chemical and bioassay results, as well as conditions of Section 103 evaluation requirements. The SF #1 site has been used on a continuous basis for Crescent City Harbor dredged material disposal since the 1970s (USACE 1994). This site would not likely be used for dredged material disposal from this project, but may be used for maintenance-dredged material disposal some time in the future. However, we analyzed the site anticipating that it would be used for this project.

C. *Upland Disposal Site*

The proposed Upland Disposal Site is located adjacent to the Crescent City Harbor Boat Basin, and is owned and operated by the Crescent City Harbor District. Currently, the sites' remaining capacity is about 27,000 cys. With the proposed upgrade of this site, 37,670 cys of dredged material could be accommodated at this site. Presently, the site's use is reserved for material from the Harbor District's dredging operations. The total Upland Disposal Site capacity is estimated to be less than 70,000 cys. The Del Norte Solid Waste Management Authority has indicated their need for about 100,000 cys of sandy material for "capping" purposes at their Crescent City landfill; material is needed for the year 2000. There are no current plans to use this material for capping purposes, however.

A pipeline dredge would be used to transport the dredged material about 1,600 feet to the Upland Disposal Site. Once the dredged material was adequately dried, it would be transported by either 10 or 15 cys capacity trucks to the landfill about 4 miles to the north. This would require about 1,000 or 1,500 one-way truck trips for the 10 or 15 cys trucks to the landfill, respectively (USACE 1994). The site was last used for disposal in September 1995. The site's current upland disposal permit expired in 1998 and continued use of the site is being negotiated by the Harbor District.

EXISTING BIOLOGICAL RESOURCES

A. Small Boat Basin Access Channel

a. Vegetation

The Access Channel consists of shallow subtidal habitat. Bull kelp and other large brown algae predominate in the coastal waters near Crescent City with green algae and red algae found to a lesser extent. While few organisms feed directly on kelp, these plants create an essential habitat in the marine environment. They support small organisms which form the food base on which larger invertebrates and fish depend. Kelp beds dampen current and wave velocities creating a micro-environment for young invertebrates and fish. Also, they often provide the only source of cover from predators for vulnerable life stages (USFWS 1989a). As a note, according to Mr. Paul Weldon (Game Warden, California Department of Fish and Game), no eelgrass exists in Crescent City Harbor.

b. Invertebrates

Two types of benthic organisms are found throughout the project area: those that live in sediments (infauna) and those that live on sediments (epifauna or epibenthos). The infauna are typically sessile, found in clusters, and usually distributed according to sediment size (USACE 1994). Although little information is available which documents the invertebrate fauna in inner-Crescent City Harbor, a variety of organisms have been reported as inhabiting the marine environment in the vicinity of the harbor. Surveys were done at the previously-designated ocean disposal site. This site is located near the Citizens Dock and Access Channel, therefore, we presume invertebrate species are about the same in the Access Channel. Common invertebrate species found there include sponges, anemones, starfish, molluscs, and crustaceans. The polychaete worm *Owenia collaris*, the gastropod *Olivella pycna*, and the bivalve *Epilucina californica* constituted the greatest abundance of benthic organisms found during sampling (Ecological Analysts, Inc. 1980).

c. Fish

The rockfish or rock cod family is a common harbor inhabitant and presumably inhabits the Access Channel area as well. They usually spawn in Crescent City Harbor in winter or early spring. The Pacific herring enters the harbor between December and February to spawn demersal eggs which adhere to the breakwaters and kelp. Juvenile coho and chinook salmon migrate out of the harbor from Elk Creek from March to June. Adult salmon can be found in the vicinity of the designated disposal area, and presumably the Access Channel, during the early summer months. Other species found in the harbor area include Dungeness crab, jack smelt, and lingcod (USACE 1994).

d. Wildlife

Between December and May, a large number of gray whales travel near the Crescent City coast in their biannual migration to and from the calving grounds in Mexico. These whales are coastal in nature and frequent the bay and harbor during this time, often being sighted within a few hundred meters of the shore. The harbor seal and the California sea lion have also been sighted in the study area. The harbor seal is an active predator in the harbor, pursuing and feeding primarily on fish but occasionally taking invertebrates as well (USACE 1994). The California sea lion may be found on offshore rocks, secluded beaches, in the bay, and on buoys (Orr and Helm 1989).

e. Special Status Species

Appendix A contains a list of federally listed threatened and endangered species in the project area. The Service has consultation responsibility for the most of the federally listed species that may be affected by the project, and the Service's Arcata Fish and Wildlife Office should be contacted regarding further consultation requirements if the project changes. The National Marine Fisheries Service (NMFS) has responsibility for most federally listed marine species, including the salmonids in the project area, and should be contacted regarding consultation requirements. The California Department of Fish and Game (Department) should be contacted regarding any species which is listed under the California Endangered Species Act.

There are 16 federally listed threatened or endangered species that may occur in the project area. Endangered species are the American peregrine falcon, leatherback turtle, tidewater goby, and western lily. Threatened species are the Steller's sea lion, marbled murrelet and it's critical habitat, Aleutian Canada goose, western snowy plover, bald eagle, northern spotted owl, loggerhead turtle, green turtle, olive (=Pacific) ridley sea turtle, coho salmon, and Oregon silverspot butterfly.

In addition there are 2 candidate species and 28 species of concern which may also be found in the project area. Refer to Appendix A for a list of these species.

B. Open Ocean Disposal Site

a. Vegetation

Phytoplankton is common in the water column and includes species of diatoms, silicoflagellates, coccolithophores, and dinoflagellates, all of which are fairly common within the California Current system. Predominant phytoplankton show seasonality in productivity and species composition. During spring/summer upwelling events, planktonic blooms occur, dominated by the diatom genera *Chaetoceros* (USFWS 1994).

b. Invertebrates

Ecological Analysts, Inc. (1980) found 127 different taxa in the benthic layer with the polychaete (*Owenia collaris*) and the gastropod (*Olivella pycna*) occurring in the highest numbers. Also, large numbers of organisms were collected in zooplankton and otter trawls, including Dungeness crab.

c. Fish

Ecological Analysts, Inc. (1980) also collected Pacific tomcod, and nightsmelt. The Service reported capturing abundant levels of yellowtail rockfish, Pacific tomcod, and nightsmelt while trawling the disposal site (USFWS 1981). The rockfish or rock cod family is a common harbor inhabitant and presumably inhabits the Access Channel area as well. They usually spawn in Crescent City Harbor in winter or early spring. The Pacific herring enters the harbor between December and February to spawn demersal eggs which adhere to the breakwaters and kelp. Juvenile coho and chinook salmon migrate out of the harbor from Elk Creek from March to June. Adult salmon can be found in the vicinity of the disposal area during the early summer months. Other species found in the harbor area include Dungeness crab, jack smelt, and lingcod (USACE 1994).

d. Wildlife

Crescent City Harbor is encompassed by the Pacific Flyway which extends from Alaska to South America. Migrating waterfowl such as the brant, Canada goose, common murre, as well as various diving ducks stop in the project area. The western grebe and red-necked grebe, are common birds associated with deeper water found offshore.

The gray whale, which is protected under the Marine Mammal Protection Act, occurs within the project area. It makes its biannual migration along the California coast. Gray whales migrate south through the area in the winter particularly from December through February, and north in the spring primarily during March and April (USFWS 1981).

e. Special Status Species

See above, under "Small Boat Basin Access Channel", "Special Status Species".

C. Upland Disposal Site

a. Vegetation

The Upland Disposal Site consists of degraded uplands containing barren areas, various grasses and forbs, and minimal shrub species. The main plant species identified are *Rumex* sp. and seashore saltgrass. The site contains vegetated internal berms, which are used to help contain the maintenance-dredged material when it is pumped on-site from an adjacent pipeline. The site was previously a wetland, however, in 1987 the site was filled and a berm placed around it (K. Kovacs, pers. comm. 1996). Since then, it has been used as a dredged material disposal site on a regular basis.

b. Invertebrates

R. Chad Roberts of Oscar Larson & Associates (1994) surveyed a wetlands area immediately adjacent to the proposed Upland Disposal Site (see "Wildlife" section below). Although no invertebrates were sampled, he assumed that there are likely hundreds of invertebrate species on the site, the most noteworthy of which are a large number of individuals of a species of sand wasp (family Sphecidae). No surveys were done for invertebrates at the Upland Disposal Site, but the same presumption could be made as for the wetlands site. During the HEP sampling effort, a large number of snails were observed inhabiting the study area (the species is unknown).

c. Wildlife

Vertebrate wildlife surveys were done by R. Chad Roberts of Oscar Larson & Associates (1994) at the wetlands site mentioned above in the "Invertebrates" section. The Service presumes that most, if not all, of the wildlife species identified at the wetlands site would use the Upland Disposal Site as well. Mammal species identified are the California ground squirrel, valley pocket gopher, and brush rabbit. Bird species are the California quail, mourning dove, violet-green swallow, cliff swallow, barn swallow, black-capped chickadee, Bewick's wren, European starling, black-headed grosbeak, white-crowned sparrow, house finch, and American goldfinch.

d. Special Status Species

See above, under "Small Boat Basin Access Channel", "Special Status Species".

FUTURE CONDITIONS WITHOUT THE PROJECT

A. Small Boat Basin Access Channel

a. Vegetation

Little or no change in vegetation is expected to occur in the project area, although suspended sediments from continued maintenance dredging of the channel would cause temporary increases in turbidity and reduced water column productivity as now.

b. Invertebrates

Invertebrates would continue to be affected by maintenance dredging. During each dredging episode, 75 percent or more of the benthic organisms are removed from the site (Allen *et al.* 1980). Sediments suspended by dredging would periodically smother some benthic communities and, if dredging takes place during a period of high water column, concentrations of invertebrate larvae, recruitment by some polychaete, amphipod, and shrimp species could be reduced. Dredging would also temporarily reduce oxygenation of the water column. The cumulative impacts of maintenance dredging over the long term would alter the distribution and abundance of benthic species and species assemblages (USACE 1972), as now.

c. Fish

The distribution and abundance of many fish species would also continue to be affected by maintenance dredging. Marine and anadromous species would tend to avoid areas of high turbidity or be periodically subjected to reduced water quality and prey abundance (USACE 1972).

d. Wildlife

Bird use of the Crescent City Harbor area would continue as now. Species utilizing terrestrial and adjacent wetland habitats would not be affected beyond the present effects of maintenance dredging. Species using open water areas of the Bay in the vicinity of the Access Channel would be periodically affected by maintenance work, which would disrupt nesting and feeding by various diving and surface-feeding wildlife. Bird, fish, and invertebrate prey would continue to be held at lowered densities within the dredged channel.

The present overall abundance and distribution of Bay area land mammals would continue to be unaffected by in-water activities. However, harbor seals' movements, feeding, and haulouts may be temporarily altered by maintenance dredging work through noise and work activities, temporarily reduced water quality, and reduced prey abundance. Other marine mammals are likely to be similarly affected by continued maintenance dredging, with overall abundances and distributions remaining as now.

B. Open Ocean Disposal Site

a. Vegetation

Phytoplankton in the water column would be subject to temporary losses of productivity due to turbidity caused by ocean disposal plume from maintenance-dredged material disposal.

b. Invertebrates

Temporary turbidity in the water column from maintenance-dredged material disposal would continue to cause suspension-feeding zooplankton to expend resources processing fine sediments, resulting in lower growth and survival rates. Coarse and coagulated dredged material would fall quickly to the ocean floor, smothering benthic infauna and altering the substrate beneath the point of disposal, as now. Mobile organisms may be able to move from, or burrow through the new sediments. Recolonization of the new substrate would be expected, although species composition may be different. Finer sediments would continue settling in broader areas with less impact (USFWS 1994).

c. Fish

Benthic and pelagic fishes would continue moving from the area during maintenance-dredged material disposal periods. The free-floating eggs and larvae of fish and other marine species may suffer decreased hatching success, and impaired larval development and feeding (USFWS 1994), as now.

d. Wildlife

The increased turbidity of the area may continue to decrease feeding opportunities for birds, as now, if overall productivity of the area is decreased. As now, marine mammals would likely avoid use of the area when the site is actually receiving dredged material (USFWS 1994).

C. Upland Disposal Site

a. Vegetation

Future disposal would regularly and temporarily impact the upland habitat as now. No significant vegetation (beyond existing) is expected to develop on the dredged material site in the future if the existing permit is renewed. However, if the existing permit is not renewed, the site would likely develop improved habitat values once the disposal activities cease, and plant species become established.

b. Invertebrates

The invertebrates that currently exist on the site would continue to be impacted through direct impacts from the disposal of dredged material.

c. Wildlife

Avian species use of the area would likely continue to be very low to non-existent. Mammals that exist on the site would continue to be temporarily impacted by disposal of dredge material from maintenance activities.

FUTURE CONDITIONS WITH THE PROJECT

A. Small Boat Basin Access Channel

a. Vegetation

About 5.15 acres of shallow subtidal habitat would be directly affected under this alternative through the deepening of the existing Access Channel. The expected adverse impacts to vegetation in the Access Channel area from proposed deepening include: 1) suspension and redistribution of bottom sediments, and 2) turbidity and siltation.

Dredging would suspend and redistribute bottom sediments, and much of this material would eventually resettle in the dredged channel. Redistribution of these sediments is a function of their settling rates and the transport mechanisms, such as coastal currents and reversing tidal currents, within the dredged channels (USFWS 1977). In addition, the deeper a channel is dredged, the faster it will accrue sediment (J. Gast, pers. comm. *in* USFWS 1995), thus requiring more frequent maintenance dredging.

The proposed channel dredging would increase turbidity and siltation. The effects of increased turbidity and siltation include the smothering of benthic flora, a reduction in light penetration, and a corresponding reduction in biological productivity of an area (USFWS 1989b). Sediments resuspended by dredging can eventually bury plant and invertebrate communities away from the site, as well as drastically reduce plant density by affecting light penetration and plant growth.

Turbidity caused by dredging can cause the larger, heavier particles such as sand and clumps of mud to settle rapidly out of suspension, while the fine silts and clays remain suspended for longer periods and are transported from the dredge site by local currents (USFWS 1977). Unconsolidated fine sediments are also returned to the water with the overflow from hopper dredges. Increased sedimentation and turbidity depend upon the type of materials, since gravel and sands settle out quickly whereas silts may remain in suspension for up to several hours (USACE 1989). It is known that suspended sediments can reduce photosynthetic production (USACE 1973). The reduction of light may significantly affect the depth to which algae can exist, as well as reduce primary productivity throughout the water column (USEPA and USFWS 1980).

Overall benthic/water column losses are quantified later herein and in Appendix C.

b. Invertebrates

The expected adverse impacts to invertebrates in the Access Channel area from proposed deepening are: 1) destruction of substrate; 2) destruction of benthic organisms of the channel bottom; 3) possible direct mortality or chronic toxicity due to resuspension of contaminants; and 4) turbidity.

Benthic habitat would be disrupted and benthic organisms destroyed at the dredge site. These impacts would likely be temporary and confined to the immediate area of the dredging operation (USACE 1995). Destruction of benthic organisms, when they are physically drawn up by dredging equipment, is one of the most direct impacts of any dredging operation. During the initial channel construction and at each maintenance dredging, 75 percent or more of the benthic organisms may be removed from the site. Unfortunately, recolonization is usually by the more opportunistic and disturbance-tolerant species (Oliver *et al.* 1977), which may be less important to fish and bird predators. This usually results in a long-term reduction in overall biological productivity.

Community resilience may actually decrease with increasing diversity, especially after a relatively severe disturbance such as dredging (Watt 1964, Dayton 1972, May 1973, Holling 1973). Also, it has been found that communities living in a highly stressed and variable physical environment (*e.g.*, shallow water offshore and the back harbor) are less complex and recover more quickly from experimental disturbance than those in more benign and less variable areas (*e.g.*, deeper water and outer harbor) (Oliver *et al.* 1977).

The long-term environmental concern with dredging is the repopulation of bottom areas where the disturbance has occurred. In dredged areas, natural or established bottom communities are destroyed, leaving a new substrate which may or may not resemble the original bottom sediments. There appears to be a need for information on benthic recovery and recolonization (Hirsch *et al.* 1978).

The recovery of the dredged site occurs over periods of weeks, months, or years depending on the environment and the type of animals and plants affected. The more naturally variable the environment, the less effect dredging will have, since animals and plants that are adapted to stressful conditions have life cycles which allow them to withstand the impacts of dredging (Hirsch *et al.* 1978).

The hydrology of the dredging sites is also important. A high degree of flushing rapidly dilutes and carries away the suspended solids, minimizing the physical and chemical effects on the benthic community. If, on the other hand, stagnant bottom conditions are created by dredging, greater changes in the benthic community can be expected. Oxygen depletion and release of growth stimulants or contaminants may have detrimental effects on the biota living in the immediate vicinity of the dredging site (USFWS 1977).

Construction-related activities would impact the water quality temporarily through the increase of sedimentation and turbidity in the immediate areas of dredging. Increased sedimentation and turbidity would be dependant upon the type of materials, since gravel and sands settle out relatively quickly, whereas silts may remain in suspension for up to several hours (USACE 1989). Siltation of adjacent habitats may interfere with the attachment by sessile invertebrates, or create soft bottom layers which are uninhabitable for many burrowing species (USACE 1973). Water quality impacts associated with the dredging project would consist mainly of localized increased turbidity and sediment quality concerns (USACE 1995).

c. Fish

Adverse impacts to fish in the Access Channel could occur through 1) removing them from the channel during dredging operations; 2) direct losses of habitat; 3) creating high levels of suspended solids in the water column during deepening; and 4) possible increased contaminant loads.

Fish would be indirectly displaced from foraging areas in and around the dredge site during dredging. The adverse impacts could be significant if work were to take place during those periods when aquatic organisms are in the process of building up fat reserves. Displacement from spawning and rearing areas would also be detrimental to fish and wildlife. Movement or migration along established routes by species such as the Pacific herring could be interrupted by project activities (USFWS 1989b). However, impacts to fish are mainly related to habitat disturbance since they are believed capable of avoiding construction activities. Fish eggs and larvae may be covered with silt and die, whereas the mobile species can leave the area (USACE 1989). To minimize or avoid impacts to rockfish and herring which spawn in the harbor, dredging should be restricted to the period from December 1 through March 1.

The destruction of benthic habitat and its benthos in the dredged area would reduce use of the channel by game and nongame fishes until habitat restoration and natural repopulation of organisms has taken place. The dredging site would probably be repopulated with some of the same fish species lost during project construction, however, this could take weeks, months, or years depending on the species of fish affected (Hirsch *et al.* 1978). Table 3 shows estimated maintenance-dredged quantities for the project.

Table 3. Estimated maintenance-dredged material quantities for the Access Channel for the Crescent City Harbor Channel Improvement Project.

CHANNEL DEPTH (MLLW)	ADVANCED MAINTENANCE DREDGING (YEARS)	FEDERAL PORTION CHANNEL DREDGING (CYS)	NON-FEDERAL PORTION CHANNEL DREDGING (CYS)
-17	3	2,365-3,550	
-15[1]	3	1,370-2,055	340-490
-14	3	690-1,040	

[1]Corps' preferred alternative.

In addition to physical disturbance of the channel bottom, the proposed channel deepening and widening would temporarily increase turbidity and siltation. The direct effects of increased turbidity on fish include: 1) inhibition of respiratory exchange through clogging of gills and abrasive action on gill filaments; 2) elimination of spawning areas; 3) reduction of fish feeding ability; and 4) establishment of anaerobic conditions (USFWS 1989b). Suspended sediments can clog and damage the gills of many species of fish. Certain life stages of several important

anadromous fish species which utilize the Harbor are particularly susceptible to these conditions. Also, because periodic maintenance would be required, the channel would be disturbed at regular intervals, preventing extensive use by fish.

d. Wildlife

Larger boats and increased traffic may produce an expansion of land-based services and facilities resulting in increased disturbance to birds and marine mammals, greater pollution, and increased occurrence of oil and chemical spills into the harbor. A deeper channel may also result in a change in current velocities, the creation of a "dead water" zone, and decreased circulation of waters, nutrients and oxygen (USFWS 1989b).

Impacts to terrestrial mammals would be caused mainly by human noise and disturbance from construction activities.

No adverse impacts to seabirds that feed in and around the harbor are expected, since they are mobile and should be able to avoid impacts from the dredging operations.

e. Special Status Species

The Corps determined that the proposed channel improvements for Crescent City Harbor would have no effect on the American peregrine falcon, marbled murrelet, bald eagle, Aleutian Canada goose, northern spotted owl, western snowy plover, tidewater goby, Oregon silverspot butterfly, and western lily. In addition, the coho salmon was included (a species under the jurisdiction of the NMFS) as well as Wolf's evening primrose a candidate species. By letter dated July 1, 1998, the Corps requested concurrence with their determination. The Service's Arcata Fish and Wildlife Office reviewed this request for the species under Service jurisdiction and concurs with the Corps' determination that the proposed project would have no effect on the above species, except for the marbled murrelet. However, since the likelihood of displacement is low, the project duration is only several days, and the species is mobile, it is likely that the level of risk of impacts to the species is insignificant. Therefore, the Service concludes that the project, as proposed, may affect, but is not likely to adversely affect, the marbled murrelet. In reaching this finding, the Service has not prescribed additional conservation measures or project modification for the Corps to implement.

A copy of the Service' biological opinion, dated July 15, 1999, is contained in Appendix A.

B. Open Ocean Disposal Site

a. Vegetation

Under with-the-project conditions, phytoplankton in the water column would be subject to temporary losses of productivity due to turbidity caused by ocean disposal plumes (USFWS 1994). These impacts would be incrementally larger in magnitude than the future without-the project conditions. We estimate a combined loss of -2.39 AAHUs (-2.13 AAHUs of deepwater benthic value and -0.26 AAHUs of open surface water value) due to disposal of dredged materials from construction and maintenance of the Access Channel.

According to Hirsch *et. al.* 1978, "habitat disruptions due to disposal are minimized at disposal sites which have a naturally unstable or shifting substrate due to wave or current action. At such sites the dredged material is rather quickly dispersed, instead of covering the area to substantial depths. This natural dispersion, which usually occurs most rapidly and effectively during the stormy winter season, can be assisted by conducting the disposal operation so as to maximize the spread of dredged material, producing the thinnest possible layer of overburden. A general case in point is ocean disposal in offshore deep water areas. Such disposal operations deposit dredged material on quiet bottom areas not subject to turbulent water movement, resulting in bottom coverage by dredged material which can be expected to remain in place for long periods of time. The thinner the layer of overburden, the easier it is for motile organisms to survive burial by vertical migration through dredged material."

"Habitat disruption can be further minimized by matching the physical characteristics of the dredged material to the substrate found at the disposal site. The ability of fauna to migrate is heavily dependent on the physical nature of the dredged material overburden" (Hirsch *et al.* 1978).

Overall open surface water/deep water benthic losses are quantified later herein and in Appendix D.

b. <u>Invertebrates</u>

Temporary turbidity increases in the water column would cause suspension-feeding zooplankton to expend more resources processing fine sediments, resulting in lower growth and survival rates, which would be increased in magnitude compared to the without-the-project conditions. Also, more coarse and coagulated dredged material would fall quickly to the ocean floor, smothering more benthic infauna and altering the substrate beneath the point of disposal. Mobile organisms may be able to move from, or burrow through, the increased new sediments. Recolonization of the new substrate would be expected, although species composition may be different. Fine sediments would settle in a broader area with less increase of incremental impacts (USFWS 1994).

"Since larval recruitment and lateral migration of adults are primary mechanisms of recolonization, recovery of physical impacts will generally be most rapid if disposal operations are completed shortly before the seasonal increase in biological activity or larval abundance in the area. Both this consideration and the desire to maximize dispersion by wave and current action would argue in many cases for winter or spring scheduling of dredging and disposal operations" (Hirsch *et al.* 1978).

c. <u>Fish</u>

Benthic and pelagic fishes would likely move from the area during disposal periods. The free-floating eggs and larvae of fish and other marine species may suffer decreased hatching success, and more impaired larval development and feeding (USFWS 1994). Some additional burial of bottom fish may occur during the disposal activity, but the passage of migrating pelagic fish

through the ocean disposal site would not be affected. Adult fish are mobile enough to avoid direct burial and smothering (USACE 1993).

d. Wildlife

More birds would be attracted to the area to feed on any surface residues from the dredged sediment. However, the increased turbidity would incrementally decrease overall feeding opportunities for most birds. If overall biological productivity is also decreased, cumulative impacts would be even larger (USFWS 1994).

Since marine mammals tend to avoid human activities, the potential for collisions between marine mammals and dredge vessels, and the direct disposal of material upon marine mammals at the ocean disposal site would not be appreciably increased over existing conditions (USACE 1993). Also, since marine mammals are so mobile, impacts on their feeding, due to turbidity increases, should not increase significantly.

e. Special Status Species

Refer to the discussion under Special Status Species for the Small Boat Basin Access Channel above and the biological opinion in Appendix A.

C. Upland Disposal Site

a. Vegetation

Dredged material would be disposed of on about 7.1 acres on the site. No vegetation would be expected to grow on the site during the drying process. No future disposal is currently planned for the site.

b. Invertebrates

The invertebrates existing on the site would continue to be impacted through direct impacts from disposal of dredged material.

c. Wildlife

Avian species' use of the area would likely continue to be very low to non-existent, as now. Only a slight, if any, increase in bird activity would be expected, perhaps due to species such as gulls being attracted to the disposed dredged materials to feed on benthic organisms and organic residues. Whatever mammals exist on the site would be temporarily impacted through indirect impacts from disturbance as now. Habitat values are expected to increase in the future if the site is allowed to remain undisturbed.

d. Special Status Species

Refer to the discussion under Special Status Species for the Small Boat Basin Access Channel above and the biological opinion in Appendix A.

DISCUSSION

A. Description of the Service's Mitigation Policy

The recommendations herein for mitigation and the protection of fish and wildlife resources conform with the Service's Mitigation Policy as published in the Federal Register (46:15 January 23, 1981). The Mitigation Policy provides Service personnel with guidance in making recommendations to protect, conserve, and enhance fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of valuable fish and wildlife resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife habitat values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife.

In applying the Mitigation Policy during an impact assessment, each specific habitat or cover-type which may be impacted by the project is identified. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category determination. Selection of evaluation species can be based on several rationales, including: 1) species known to be sensitive to specific land and water use actions; 2) species that play a key role in nutrient cycling or energy flow; 3) species that utilize a common environmental resource; or 4) species that are associated with important resource problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. Evaluation species used for Resource Category determinations may or may not be the same evaluation elements used in an application of the Service's HEP, if one is conducted. Finally, based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation goals range from "no loss of existing habitat value" (Resource Category 1) to "minimize loss of habitat value" (Resource Category 4). The goal for Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses of habitat value would need to be replaced in-kind. As defined in the Mitigation Policy, "in-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

In addition to mitigation planning goals based on habitat values, Region 1 of the Service, which includes California, has a mitigation goal of no net loss of acreage for wetland habitat. This goal applies to all impact analyses.

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's

regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectification measures, measures to reduce or eliminate impacts over time, and compensation measures.

B. Habitat Evaluation Procedures

HEP is a methodology developed by the Service and other resource and water development agencies for documenting the quality and quantity of available habitat for selected fish and wildlife species. HEP and its uses are described in detail in the attached Appendix B.

The fish and wildlife impact evaluations for the project were conducted using a combination of HEP (on the proposed Upland Disposal Site for which existing Habitat Suitability Index (HSI) models were applicable) (Appendix B), and a HEP-like habitat-based assessment using word models initially developed for the Oakland and Richmond Harbor Navigation Projects (USFWS 1994, USFWS 1996), and modified for the Crescent City Harbor Project (on the Access Channel and Open Ocean Disposal Sites) (Appendices C and D). Hereinafter, however, all such impact evaluations for this project are referred to as "HEPs".

C. General Methodology

Acreage of the Upland Disposal Site was planimetered from a 1:1,200 blueline aerial photograph. Acreage at the proposed dredged area (Access Channel) was planimetered from a 1:2,400 blueline (check if use new map and it has a new scale) aerial photograph.

Copies of the various HSI models for the Upland Disposal Site HEPs are included in Appendix B. These models were chosen because they were readily available, their variables included characteristics of the cover-types that would change with the project, and their relative simplicity facilitated completing the HEPs in a timely manner. These models were designed as planning tools, however, and as such are not exhaustive syntheses of everything that can possibly affect each species.

The HSI models did meet certain usability constraints as follows:

1) They were based on habitat variables that can be determined for existing conditions and reasonably predicted for future conditions, both with- and without-the-project; such criteria are needed both for impact assessment and the development of mitigation recommendations.

2) They were simple enough to allow adequate time for users to implement them in the HEP, and make appropriate conclusions and recommendations.

3) They could be applied at any time of the year (i.e., existing data should be available to assess the model variables if field sampling is not possible).

For the area to be dredged (Access Channel), we used the same approach as was applied for our analyses of the Oakland and Richmond Harbor Navigation Projects (USFWS 1994, 1996). The

approach is to establish an aggregate HSI which represents our best professional opinion about the overall value of the habitat under with- and without-project conditions. Assignment of the HSI takes into account a variety of factors which can affect habitat value, such as (a) depth-related factors like contaminant accumulation and biological productivity, (b) physical disruption due to initial project construction, including changes in surrounding water quality, (c) increases or decreases in the frequency of maintenance dredging, and (d) increases or decreases in the level of shipping activity.

We previously evaluated ocean disposal alternatives for Richmond and Oakland harbors at the SF-DODS, a USEPA-designated site in deep water west of the Golden Gate (USFWS 1994, 1996). The designation process involves a careful accounting of the site characteristics, and changes resulting from disposal (USEPA 1993). Although detailed information has not yet been developed for the Open Ocean Disposal Site, we evaluated the results of past characterization of the site and bioassay information of the effects of Crescent City dredged material on marine invertebrates and fish (EA 1980, Toxscan 1993). These studies were done nearby, but not within, the Access Channel location.

Because of the shallower waters of SF #1, only two cover-types were analyzed for this site: open surface waters and deepwater benthos. The model we applied is a version used previously for Oakland and Richmond Harbor (USFWS 1994, USFWS 1996) and consists of three community-based Suitability Indices (or SIs) which are assigned for each cover-type, then averaged to obtain the Habitat Suitability Index (HSI). These SIs are: 1) X1 - use of the habitat by the evaluation species, where the extent of use is ranked relative to the observation of such species within the impact area compared to other habitats within the species' population range, 2) X2 - overall community diversity, and 3) X3 - the evaluation species' commercial and/or recreational value.

For consistency with HEP, we used the standard 0.0 to 1.0 range for each SI. The impact areas and SIs were estimated using our best professional biological judgement of the physical changes and resource responses anticipated due to disposal. These were based on our review of available information about the site and its characteristics, which are explained in Appendix D.

More detailed descriptions of methodologies are given in the HEPs (Appendices B, C, and D).

D. Evaluation of Project Impacts and Mitigation Needs

This section contains the following discussions: 1) habitats, evaluation species, and mitigation goals, 2) evaluation of project impacts, 3) evaluation of mitigation needs, and 4) potential mitigation sites and options for the Access Channel, Open Ocean Disposal Site, and Upland Disposal Site. In each of the HEP analyses, estimates of acreages needed for replacement mitigation are given. These are based on the designs of the project, as presently stated by the Corps. In some instances, these designs may not have yet incorporated all of the more desirable forms of mitigation (i.e., *avoidance*, *minimization, reduction, and/or rectifying impacts*), before *replacement mitigation* was considered. Therefore, the Service's statement of certain *replacement mitigation* needs should not be construed as our acknowledgment that all other more desirable forms of mitigation have been fully exhausted by the Corps.

a. **Small Boat Basin Access Channel**

1. ***Habitats, Evaluation Species, and Mitigation Goals***

Shallow unvegetated or vegetated subtidal habitat is found at 0 to 20 feet MLLW. Shallow unvegetated or vegetated subtidal habitat is of high to medium value for the evaluation species. The evaluation species selected to determine the value of this subtidal habitat are marine fishes that depend on these areas to complete their life cycle, such as the Pacific herring. Marine fishes were selected because of their importance to the commercial and sport fisheries. The Service finds that the shallow subtidal habitat that would be impacted by the project should have a mitigation planning goal of no net loss of in-kind habitat value while minimizing loss of in-kind habitat value (Resource Category 3) (Table 4).

2. ***Evaluation of Project Impacts***

We estimate a loss of 1.09 AAHUs of subtidal benthic habitat value would occur due to construction and maintenance of the Access Channel, compared with existing conditions. At the same time, we expect a modest gain in water column habitat value of 0.69 AAHUs, a result which can be attributed to the use of a less dispersive dredging method.

Table 4. Evaluation species, Resource Categories, and mitigation goals for the habitat types in the area affected by Crescent City Harbor Improvement Project.

HABITAT TYPE	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION PLANNING GOALS
Shallow subtidal	Marine fishes	3	No net loss of habitat value while minimizing loss of in-kind habitat value
Uplands	Small mammals	4	Minimize loss of habitat value
Open surface water	Seabirds	3	No net loss of habitat value while minimizing loss of in-kind habitat value
Deep water benthos	Dungeness crab	3	No net loss of habitat value while minimizing loss of in-kind habitat value

In our recent evaluation of larger navigation projects for the more industrialized harbor Ports of Richmond and Oakland, we recommended mitigation for *all* harbor impacts, including cover-types in Resource Categories 3 and 4. The rationale for doing so is several-fold: first, to encourage the maximum beneficial re-use of dredged material for habitat purposes such as wetland creation, or levee reinforcement around agricultural wetlands; second to compensate the

extensive cumulative impacts of all dredging activities around San Francisco Bay; and third, such a recommendation acknowledges the severe degradation associated with large-scale harbor operations. The proposed Access Channel in Crescent City Harbor differs from the larger projects. Opportunities for beneficial re-use for habitat purposes have not been identified for this area. The proposed activity would not result in extensive industrialization or risks associated with offloading activities, and there is no substantial contamination of the harbor compared to reference areas. Also, the proposed project does not contribute to large cumulative impacts within the region. Finally, the calculated loss of habitat values are minimal and restricted to a very small area (5.15 acres).

3. *Evaluation of Mitigation Needs*

The proposed activity would not: 1) result in extensive industrialization or risks associated with offloading activities; 2) substantially contaminate the harbor compared to reference areas; 3) contribute to large cumulative impacts within the region; and 4) result in large habitat value losses, which are restricted to a 5.15 acres. Therefore, the Service does not recommend mitigation for impacts of construction of the Access Channel at this time.

4. *Potential Mitigation Sites and Options*

See "Evaluation of Mitigation Needs" above.

b. Open Ocean Disposal Site

1. *Habitats, Evaluation Species, and Mitigation Goals*

Open ocean surface water and deep water benthic habitats at the proposed ocean disposal site may be directly or indirectly affected by the proposed project. The open ocean surface waters provide feeding and nesting areas for numerous seabird species. Marine mammals, pelagic fishes, and planktonic macroinvertebrates are also dependent on this habitat for feeding and other life requisites.

The evaluation species selected for open ocean surface water areas are seabirds, such as murrelets and common murres. These species were selected because of 1) the Service's responsibilities for their management under the Migratory Bird Treaty Act; 2) their relatively high value for non-consumptive human uses such as bird-watching; 3) their dependency on this habitat for feeding; and 4) their use of this habitat for wintering. Open ocean surface waters are abundant off the northern California coast. Because the habitat is of high to medium value to the evaluation species and is abundant in the project area and region, our mitigation goal is no net loss of habitat value while minimizing loss of in-kind habitat value (Resource Category 3) (Table 4).

Deep water benthic habitat provides foraging areas for numerous species including crabs and other invertebrates, as well as bottom dwelling fishes. The Dungeness crab was selected as the evaluation species for this habitat. This species was selected because of 1) its use of the deep water benthic habitat as a foraging ground, and 2) its high value to sport and commercial fisheries. Deep water benthic habitat has moderately high value for the evaluation species and is

abundant on the northern California coast; therefore, our mitigation planning goal is "no net loss of habitat value while minimizing loss of in-kind habitat value" (Resource Category 3) (Table 4).

2. *Evaluation of Project Impacts*

We estimate a combined loss of -2.39 AAHUs (-2.13 AAHUs of deepwater benthic value and -0.26 AAHUs of open surface water value) due to disposal of dredged materials from construction and maintenance of the Access Channel. These are considered very low losses in comparison with an estimate of 1,919 AAHUs for the much greater volume of disposal expected at the SF-DODS site, which could accept up to a combined 6 million cys per year of dredged material from an array of San Francisco Bay area channels (USFWS 1996). We have recently encouraged mitigation in situations where, as in San Francisco Bay, there is 1) evidence of contamination of the dredged material; 2) opportunities for alternative beneficial re-use of dredged material exist; and 3) the specific project under consideration contributes to much larger cumulative disposal impacts. This is not the case for Crescent City Harbor. Material from construction and maintenance of the project would represent a small increase in total disposal volume, the material is suspected to be free of toxic impacts, and the total disposal volume for SF #1 is relatively low. There are no known opportunities for beneficial re-use. We are unaware of other potential disposal activities which would contribute to a cumulative impact at SF #1.

3. *Evaluation of Mitigation Needs*

Assuming that a) Crescent City Harbor is the sole source of material, b) disposal does not exceed the volumes assumed in this analysis, and c) USEPA "greenbook" testing shows no contaminants or toxicity, we do not recommend mitigation if SF #1 is selected as the disposal alternative for construction of an Access Channel at Crescent City Harbor.

4. *Potential Mitigation Sites and Options*

See "Evaluation of Mitigation Needs" above.

c. <u>Upland Disposal Site</u>

1. *Habitats, Evaluation Species, and Mitigation Goals*

The uplands cover-type contains a variety of grasses, forbs, and some shrubs, as well as barren areas. The evaluation species selected to represent the value of this cover-type are small mammals such as the California ground squirrel and valley pocket gopher. Small mammals were chosen because of their value as indicator species for other animals which utilize uplands in the project area. This cover-type typically supports the small mammal prey-base for raptors. The Service finds that the uplands cover-type should have a mitigation planning goal of "minimize loss of habitat value" (Resource Category 4) (Table 4).

2. *Evaluation of Project Impacts*

Two scenarios were projected for the HEP. For Scenario #1, given the assumption that the existing permit for dredged material disposal at the site will be renewed, the results of the HEP indicate there will be no additional adverse impact when comparing the future with- and without-the project. This is not unexpected, since essentially the same land use occurring now will be

continued in the future. The major difference is that the volume of dredged material that may be removed from the Harbor during maintenance activities will increase with the greater-sized project.

For Scenario #2, we took into consideration that at the present time, there is no written assurance that the permit(s) required to continue use of this particular disposal site exist. Therefore, a second scenario was run in the HEP. The purpose of this second HEP run was to provide an estimate of what the adverse impacts of using this site in the future for dredged material disposal might be from this project or future project activities, if the site was not permitted in the future. In this planning scenario, the permitted use of the site was not renewed, but the initial project dredging was completed prior to the expiration of the existing permit. The HEP was then rerun with an assumption that the site will develop improved upland habitat values once disposal activities on the site cease. The results of this second analysis indicate that the savannah sparrow and yellow warbler would have net losses of -2.97 and -3.87 AAHUs, respectively, over the life of the project if the site is used for disposal in the future. This second HEP run is only a planning tool intended to highlight the fact that there may be project impacts in the future depending on whether the site is permitted and continued to be used for dredged material disposal. There are no current plans for future use of the site for dredged material disposal.

3. *Evaluation of Mitigation Needs*

No mitigation would be required, since there would be no adverse impacts.

E. Contaminants Discussion

Sediment testing showed levels of Nickel and Chromium above the acceptable level for open ocean disposal (USACE 1998, Appendix A). Additional tests, such as waste extraction and benthic bioassays, could be performed to further evaluate the potential toxicity of the dredged material for a final risk analysis.

RECOMMENDATIONS

If the structural alternative is chosen, the Service recommends that the Corps implement the following:

1. Avoid impacts to the wetland areas along the north and west sides of the upland disposal site by taking appropriate measures to prevent construction activities from affecting these wetlands.

2. Minimize impacts on critical life stages of important fish and wildlife species which use the Crescent City Harbor by restricting dredging for the project to the late-August-to-early-November period to the extent feasible. Future maintenance dredging should be restricted to this same "window" as well. Also, avoid all dredging during the Pacific herring spawning season (December 1 through March 1) in harbor waters.

3. Complete sediment sampling and testing in order to finalize a dredging and disposal plan and commit to using appropriate sediment screening criteria, such as the USEPA's "Green Book". Sediments for which suitabilities cannot be agreed upon should be disposed of in a manner which would minimize detrimental impacts to fish and wildlife resources.

4. Contact the Service or NMFS, as appropriate, if new information reveals that the proposed project may affect listed species or critical habitat in a manner or an extent not considered in your previous correspondence, the action is modified in a manner that causes an effect to listed species or critical habitat not considered in your correspondence, or a new species or critical habitat is designated that may be affected by the proposed activity.

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ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF THE FOLLOWING SELECTED QUADS
April 8, 1996

QUAD : 723B SISTER ROCKS

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)
marbled murrelet, *Brachyramphus marmoratus* (T)
Aleutian Canada goose, *Branta canadensis leucopareia* (T)
western snowy plover, *Charadrius alexandrinus nivosus* (T)
bald eagle, *Haliaeetus leucocephalus* (T)
northern spotted owl, *Strix occidentalis caurina* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

Plants

western lily, *Lilium occidentale* (E)

Proposed Species

Fish

Coho salmon, *Oncorhynchus kisutch* (PT)
Klamath Mts. Province steelhead, *Oncorhynchus mykiss* (PT)

Species of Concern

Mammals

white-footed vole, *Arborimus albipes* (SC)
California red tree vole, *Arborimus pomo* (SC)
Pacific fisher, *Martes pennanti pacifica* (SC)
small-footed myotis bat, *Myotis ciliolabrum* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

northern goshawk, *Accipiter gentilis* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

tailed frog, *Ascaphus truei* (SC)
Del Norte salamander, *Plethodon elongatus* (SC)

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF THE FOLLOWING SELECTED QUADS
April 8, 1996

QUAD : 723B SISTER ROCKS

Species of Concern

Amphibians

northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

sandy beach tiger beetle, *Cicindella hirticollis gravida* (SC)

mardon skipper, *Polities mardon* (SC)

ground beetle (no common name), *Scaphinotus behrensi* (SC)

Plants

northcoast sand-verbena, *Abronia umbellata ssp. breviflora* (SC)

Wolf's evening-primrose, *Oenothera wolfii* (SC)

QUAD : 740C CRESCENT CITY

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

marbled murrelet, *Brachyramphus marmoratus* (T)

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

northern spotted owl, *Strix occidentalis caurina* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

Invertebrates

Oregon silverspot butterfly, *Speyeria zerene hippolyta* (T)

Plants

western lily, *Lilium occidentale* (E)

Proposed Species

Fish

Coho salmon, *Oncorhynchus kisutch* (PT)

Klamath Mts. Province steelhead, *Oncorhynchus mykiss* (PT)

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF THE FOLLOWING SELECTED QUADS
April 8, 1996

QUAD : 740C CRESCENT CITY

Species of Concern

Mammals

white-footed vole, *Arborimus albipes* (SC)
California red tree vole, *Arborimus pomo* (SC)
Pacific fisher, *Martes pennanti pacifica* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

northern goshawk, *Accipiter gentilis* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

tailed frog, *Ascaphus truei* (SC)
Del Norte salamander, *Plethodon elongatus* (SC)
northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)
southern torrent (seep) salamander, *Rhyacotriton variegatus (=olympicus)* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)
Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

sandy beach tiger beetle, *Cicindella hirticollis gravida* (SC)
Fort Dick limnephilus caddisfly, *Limnephilus atercus* (SC)
rocky coast Pacific sideband snail, *Monadenia fidelis pronotis* (SC)
mardon skipper, *Polities mardon* (SC)
ground beetle (no common name), *Scaphinotus behrensi* (SC)

Plants

northcoast sand-verbena, *Abronia umbellata ssp. breviflora* (SC)
Thurber's reedgrass, *Calamagrostis crassiglumis* (SC)
Wolf's evening-primrose, *Oenothera wolfii* (SC)
sand dune phacelia, *Phacelia argentea* (SC)
valley sagittaria, *Sagittaria sanfordii* (SC)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825

1-1-96-SP-750 April 8, 1996

Mr. Peter LaCivita, Chief
Environmental Planning Section
Army Corps of Engineers
211 Main Street
San Francisco, CA 94105-1905

Subject: Species List for Proposed Crescent City Harbor Dredging

Dear Mr. LaCivita:

As requested by letter from your agency dated January 19, 1996, you will find enclosed a list of the listed, proposed, and/or candidate species that may be present in or may be affected by projects in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service (Service) to provide a species list pursuant to section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The Service used your map(s) and/or other information to locate the proposed project on a U.S. Geological Survey (USGS) 7.5 minute quadrangle map. The species on the enclosed list(s) are those species we believe may occur within, or be affected by projects within, the USGS 723B and 740C quads, where your project is planned. Some of the species may not be affected by the proposed action. A trained biologist or botanist, familiar with the habitat requirements of the listed species, should determine whether these species or habitats suitable for these species may be affected by the proposed action.

Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is available upon request. This information may be helpful in preparing the biological assessment for this project, if one is required. Please see Enclosure B for a discussion of the responsibilities Federal agencies have under section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal agency or its designated non-Federal representative.

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
777 Sonoma Ave. Rm 325
Santa Rosa, CA 95404

January 29, 1996 F/SW031:PR

Mr. Peter E. LaCivita
Corps of Engineers
San Francisco District
211 Main Street
San Francisco, California 94105-1905

Dear Mr. LaCivita:

Thank you for requesting information regarding the presence of federally listed threatened or endangered species or critical habitat that may be affected by U.S. Army Corps of Engineers' proposal to dredge material from the Crescent City Harbor.

Available information indicates that there are no federally listed species or critical habitat under the management authority of the National Marine Fisheries Service (NMFS) at the proposed project site. However, coho salmon are proposed for listing as threatened under the federal Endangered Species Act (ESA) (60 FR 38001) and may occur in the project area. In addition, NMFS is currently conducting status reviews for chinook salmon and steelhead trout pursuant to the ESA, and these species may occur in the project area.

If you have questions concerning these comments, please contact Ms. Penny Ruvelas of my staff at (707) 578-7513.

Sincerely,

Gary Stern

Gary Stern
Supervisory Fishery Biologist

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105-1905

January 23, 1996

Planning Branch

Mr. James Bybee
Northern Area Coordinator
National Marine Fisheries Service
777 Sonoma, Room 325
Santa Rosa, California 95404

Dear Mr. Bybee,

The United States Army Corps of Engineers (COE) and the Crescent City Harbor District intend to dredge approximately 50,000 cubic yards of material to deepen the access channel into the small boat basin at Crescent City Harbor. The project is currently in the planning phase and construction should begin in 1997. Disposal options under consideration include:

- beach nourishment at South Beach, just south of Crescent City harbor,

- ocean disposal at SF-1, located at 41°43'15''N 124°12'10''W,

- and upland disposal at the Crescent City Landfill near the airport after drying at a Harbor District run facility next to the small boat basin.

COE requests a list of any species of concern under your jurisdiction within the project area (see enclosure). We have also requested a list of threatened and endangered species from the United States Fish and Wildlife Service.

Please contact Mr. Eric Jolliffe at (415) 744-3341 with any questions or comments.

Sincerely,

Peter E. LaCivita
Chief, Environmental Planning Section

Enclosure

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105-1905

January 19, 1996

Planning Branch

Mr. Joel A. Medlin
Field Supervisor
U.S. Fish and Wildlife Service
2800 Cottage Way E1803
Sacramento, California 95825

Dear Mr. Medlin:

The United States Army Corps of Engineers (COE) and the Crescent City Harbor District intend to dredge approximately 50,000 cubic yards of material to deepen the access channel into the small boat basin at Crescent City Harbor. The project is currently in the planning phase and construction should begin in 1997. Disposal options under consideration include:

- beach nourishment at South Beach, just south of Crescent City Harbor,

- ocean disposal at SF-1, located at 41°43'15''N 124°12'10''W,

- and upland disposal at the Crescent City Landfill near the airport after drying at a Harbor District run facility next to the small boat basin.

COE requests a list of any endangered, threatened, and candidate species, as well as any critical habitat areas designated or proposed pursuant to the Endangered Species Act. A map of the project area with disposal option locations is enclosed. The project will occur entirely within the Crescent City and Sister Rocks quadrangles.

Please contact Mr. Eric Jolliffe at (415) 744-3341 with any questions or comments.

Sincerely,

Peter E. LaCivita

Peter E. LaCivita
Chief, Environmental Planning Section

Enclosure

APPENDIX B
SPECIES LETTERS AND ENDANGERED SPECIES CORRESPONDENCE

APPENDIX A

ENDANGERED SPECIES CONSULTATION

Endangered and Threatened Species that May Occur in or be Affected by Projects in the Following Selected Quads

July 14, 1998

QUAD : 723B SISTER ROCKS

Listed Species

Mammals

Steller (=northern) sea-lion, *Eumetopias jubatus* (T)

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

marbled murrelet, *Brachyramphus marmoratus* (T)

marbled murrelet critical habitat, *Brachyramphus marmoratus* (T)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

northern spotted owl, *Strix occidentalis caurina* (T)

Reptiles

leatherback turtle, *Dermochelys coriacea* (E)

loggerhead turtle, *Caretta caretta* (T)

green turtle, *Chelonia mydas (incl. agassizi)* (T)

olive (=Pacific) ridley sea turtle, *Lepidochelys olivacea* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

coho salmon, So OR/No CA, *Oncorhynchus kisutch* (T)

Plants

western lily, *Lilium occidentale* (E)

Proposed Species

Fish

Klamath Mts. Province steelhead, *Oncorhynchus mykiss* (PT)

QUAD : 723B   SISTER ROCKS

Species of Concern

Mammals

white-footed vole, *Arborimus albipes* (SC)

California red tree vole, *Arborimus pomo* (SC)

Pacific fisher, *Martes pennanti pacifica* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

northern goshawk, *Accipiter gentilis* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

tailed frog, *Ascaphus truei* (SC)

Del Norte salamander, *Plethodon elongatus* (SC)

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

sandy beach tiger beetle, *Cicindela hirticollis gravida* (SC)

mardon skipper, *Polites mardon* (SC)

ground beetle (no common name), *Scaphinotus behrensi* (SC)

QUAD : 723B · SISTER ROCKS

Species of Concern

Plants

northcoast sand-verbena, *Abronia umbellata ssp. breviflora* (SC)

Wolf's evening-primrose, *Oenothera wolfii* (SC)

QUAD : 740C CRESCENT CITY

Listed Species

Mammals

Steller (=northern) sea-lion, *Eumetopias jubatus* (T)

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

marbled murrelet, *Brachyramphus marmoratus* (T)

marbled murrelet critical habitat, *Brachyramphus marmoratus* (T)

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

northern spotted owl, *Strix occidentalis caurina* (T)

Reptiles

leatherback turtle, *Dermochelys coriacea* (E)

loggerhead turtle, *Caretta caretta* (T)

green turtle, *Chelonia mydas (incl. agassizi)* (T)

olive (=Pacific) ridley sea turtle, *Lepidochelys olivacea* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

coho salmon, So OR/No CA, *Oncorhynchus kisutch* (T)

Invertebrates

Oregon silverspot butterfly, *Speyeria zerene hippolyta* (T)

Plants

western lily, *Lilium occidentale* (E)

QUAD : 740C   CRESCENT CITY

Proposed Species

Fish

Klamath Mts. Province steelhead, *Oncorhynchus mykiss* (PT)

Species of Concern

Mammals

white-footed vole, *Arborimus albipes* (SC)

California red tree vole, *Arborimus pomo* (SC)

Pacific fisher, *Martes pennanti pacifica* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

northern goshawk, *Accipiter gentilis* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

tailed frog, *Ascaphus truei* (SC)

Del Norte salamander, *Plethodon elongatus* (SC)

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

southern torrent (seep) salamander, *Rhyacotriton variegatus (=olympicus)* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

sandy beach tiger beetle, *Cicindela hirticollis gravida* (SC)

Fort Dick limnephilus caddisfly, *Limnephilus atercus* (SC)

QUAD : 740C CRESCENT CITY

Species of Concern

Invertebrates

rocky coast Pacific sideband snail, *Monadenia fidelis pronotis* (SC)

mardon skipper, *Polites mardon* (SC)

ground beetle (no common name), *Scaphinotus behrensi* (SC)

Plants

northcoast sand-verbena, *Abronia umbellata ssp. breviflora* (SC)

Thurber's reedgrass, *Calamagrostis crassiglumis* (SC)

Wolf's evening-primrose, *Oenothera wolfii* (SC)

sand dune phacelia, *Phacelia argentea* (SC)

valley sagittaria, *Sagittaria sanfordii* (SC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened.
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(*)		Possibly extinct.
	Critical Habitat	Area essential to the conservation of a species.

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND (c) OF THE ENDANGERED SPECIES ACT

Section 7(a): Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species; 2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and 3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

Section 7(c): Biological Assessment - Major Construction Activity[1]

Requires Federal Agencies or their designees to prepare a Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action[2] on listed and proposed species. The process begins with a Federal agency requesting from FWS a list of proposed and listed threatened and endangered species. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the list, the accuracy of the species list should be verified with the Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

We recommend the following for inclusion within the BA: an on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities, and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of indirect effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

---

[1]A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332(2)C).

[2]"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

Guidelines for Conducting Sensitive Plant Surveys

The Fish and Wildlife Service (Service) recommends that complete botanical inventories be made during the pre-construction phase for individual projects. Special attention should be paid to searching for the species listed in any pre-project comments, but should not be restricted to those species. To ensure adequate botanical surveys have been performed, the Service recommends the following minimum guidelines:

(1) If a listed or proposed species is known to occur within the same habitat and the area of the project is within the historic range of the special status plant, the botanist(s) performing the survey should: (a) check nearby reference sites to observe phenology of known populations; and (b) make multiple visits during appropriate phenological stage. Results should be documented with photographs and by a written description of the reference site(s) including information on phenology and microhabitat. Dates on which the surveys were performed should be included.

(2) The surveys should be floristic. They should not be conducted to determine the presence or absence of single rare plant species. A regional list comprised of several counties should be examined for plants occurring in the appropriate habitat. The site should also be surveyed and a complete species list provided. Plants should be identified to the extent necessary to determine if they are rare or endangered (e.g., it is not adequate to just identify to genus, if there are any rare plants occurring in that genus.

(3) Methods used for the survey need to be detailed in the environmental assessment. A detailed description of the protocol used should include (a) how the habitat on the site was inspected; (b) the dates the survey was performed; (c) the reference sites, if any, that were visited; (d) the phenology of plants at the time of the survey; (e) microhabitat information; (f) complete species lists for the site. Detailed information should also be provided in any mitigation plan as well.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ARCATA FISH AND WILDLIFE OFFICE
1125 16TH STREET, ROOM 209
ARCATA, CA 95521
(707) 822-7201
FAX (707) 822-8136

FILE COPY

In Reply Refer To:
1-14-1998-150b

July 15, 1999

Peter E. LaCivita
Chief, Environmental Planning Section
Department of the Army
San Francisco District, Corps of Engineers
333 Market St., 7th Floor
San Francisco, California 94105-2197

Subject: Crescent City Harbor Federal Channel Extension and Deepening Project

Dear Mr. LaCivita:

This letter responds to your correspondence of July 1, 1998 (received by the Arcata Fish and Wildlife Office (AFWO) on July 20, 1998) requesting concurrence from the U.S. Fish and Wildlife Service (Service) with your determination that the proposed project, Crescent City Harbor Federal Channel Extension and Deepening Project, Del Norte County, California, would have no effect on any listed or proposed species in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act). This document transmits the Service's findings regarding your determination of effects.

The Army Corps of Engineers (Corp) requested the Service's concurrence with the Corp's determination that the projects would have no effect on the American peregrine falcon (*Falco peregrinus anatum*), marbled murrelet (*Brachyramphus marmoratus*), bald eagle (*Haliaeetus leucocephalus*), Aleutian Canada goose (*Branta canadensis leucoparaeia*), northern spotted owl (*Strix occidentalis caurina*), western snowy plover (*Charadrius alexandrinus nivosus*), tidewater goby (*Eucyclogobius newberryi*), Oregon silverspot butterfly (*Speyeria zerene hippoltya*), and western lily (*Lilium occidentale*). In addition, the coho salmon (*Oncorhynchus kisutch*) is addressed in the EA, but is a species under the regulatory jurisdiction of the National Marine Fisheries Service. Also, potential effects on the Wolf's evening primrose (*Oenothera wolfii*), a candidate species, was addressed in the EA, as well as several Species of Concern.

The Service reviewed the most recent biological assessment prepared by the Corps (dated May 1999). This consultation is also based upon conversations between Eric Joliffe, Tamara Terry and Peter LaCivita of the Corp and Ray Bosch of AFWO. A complete administrative record of this consultation is on file in this office.

Consultation History

The consultation history on this project has includes a series of correspondences resulting from changes to the proposed action. The changes to this project were identified in a series of Environmental/Biological Assessments (EA). The history of consultation on this project is as follows:

On May 21, 1998, the AFWO sent a species list to the Corp for their consideration during the preparation of the EA.

On July 1, 1998, the Corp sent to the Sacramento Fish and Wildlife Office (SFWO) (received July 8, 1998) the *Draft Environmental Assessment, Biological Assessment and Consistency Determination, Crescent City Harbor Federal Channel Extension and Deepening General Re-evaluation Report, Crescent City Harbor, Del Norte County, California*. The Corp requested written concurrence from the Service that no listed or proposed species would be affected by the proposed project. Subsequently, SFWO forwarded this document to AFWO, as AFWO had recently acquired jurisdiction within the Service for the project area on the north coast. The AFWO received that document on July 20, 1998.

On July 2, 1998, the Corp transmitted to the AFWO (received July 6, 1998) the *Draft Environmental Assessment For Fiscal Year (FY) 1998 Operations and Maintenance Dredging of the Crescent City Harbor Federal Channels, Del Norte County, California* (dated June 1998). The Corps requested that the Service provide written comments on the draft EA within 30 days.

On August 3, 1998, the AFWO responded to the Corp's request for a written response. The Service indicated that its comments pertained to both projects covered under the two Environmental Assessments that had been submitted, because the two projects, as then proposed, were closely associated and were likely to have similar effects on listed species. The Service did not concur with the Corp's "no effect" determinations for the listed species, and requested additional information about potential effects on several of the species in the project area.

On September 30, 1998, the Corp provided written response (received October 2, 1998) to the Service's request for clarification and additional information regarding effects on listed species.

Also on October 2, 1998, the AFWO received a copy of the *Final Environmental Assessment for Fiscal Year (FY) 1998 Operations and Maintenance Dredging of the Crescent City Harbor Federal Channels, Del Norte County, California* (dated August 1998).

On April 12, 1999, Eric Joliffe (Corps staff) sent to Ray Bosch (AFWO staff) a copy of the *Crescent City Harbor General Reevaluation Report For Navigation Improvements, Del Norte County, California* (dated March 4, 1999). At that time, Mr. Joliffe indicated that the Corp changed the project to include only upland disposal, and was modifying the upland disposal site to handle additional volume of disposal materials.

On June 24, 1999, Eric Joliffe transmitted a copy of the most recent draft of the *Environmental Assessment, Biological Assessment and Consistency Determination for the Crescent City Harbor*

Federal Channel Extension and Deepening General Re-Evaluation Report, Crescent City Harbor, Del Norte County, California, dated May 1999. This document indicates the changes that the Corp has incorporated into the final project description upon which this consultation is based, and the expected extent of impacts to listed species.

Description of the Proposed Action

The proposed structural alternative is to dredge an approximately 1,200-foot long access channel from the federal Inner Harbor Channel to the entrance of the Small Boat Basin in the harbor of Crescent City, Del Norte County, California. Channel bottom width would range from 140 feet to 210 feet, where it would flare to meet the Inner Harbor Channel. This flare is designed to facilitate the navigation through the turn from the Inner Harbor Channel. The turn and entrance into the Small Boat Basin would be as wide as the existing boat basin levees would permit. The channel side slopes would be excavated with a one foot vertical to three foot horizontal ratio. The non-Federal portion of the project consists of deepening the area between the proposed Federal Channel and the northwest side of Citizen's Dock.

This channel design would provide a minimum two-way traffic plan in the access channel, which is the minimum acceptable channel configuration, and most closely resembles the current channel operation.

Economic optimization resulted in a design depth of minus14 feet mean lower low water (MLLW) plus one foot of advanced maintenance and a one-foot overdepth allowance. The actual dredging method is anticipated to be a hydraulic operation. Dredge material would mostly be sandy with small amounts of broken rock (less than 10%). Some shale and graywacke may be encountered in the deeper portion of the channel, and a cutter-head dredge may be required. Approximately 37,670 cubic yards of material would be dredged. The dredged material would be transported through a pipeline to the Harbor District's nearshore upland disposal site.

Maintenance dredging of the access channel would be performed on a five year cycle and would remove an average of 16,000 cubic yards of dredged material per cycle. Two existing federal channels would be combined into one proposed project in one maintenance operation, producing an estimated average quantity of 66,000 cy of O&M dredged material every five years. The anticipated disposal site for maintenance dredged material is SF-1 which would first require designation by the U.S. Environmental Protection Agency as an ocean disposal site under Section 102 of the Marine Protection Research and Sanctuaries Act of 1972 (MPRSA). Limited quantities of maintenance dredged material deemed acceptable for beach nourishment could be placed at Whaler Island.

Status of the Species and Effects of the Proposed Action

Actions similar to the proposed action have the potential to result in impacts to listed species through habitat removal and/or disturbance effects. Habitat removal could occur from deposition of dredged material at the upland disposal site, or from turbidity emanating from the dredge site. Disturbance effects could occur to some species temporarily displaced by the noise levels and human presence associated with dredging and disposal activities, above those levels of

disturbance currently found in the harbor area, especially if conducted during the breeding season.

In general, wildlife species can be adversely affected if behaviors associated with breeding, feeding or sheltering are modified due to human activities. For example, species temporarily displaced from normal roosting or foraging habitat could be considered to have been adversely affected by the activity causing the displacement. In cases where this displacement or behavioral modification is particularly acute (e.g., modifying behaviors associated with nest attendance), the effect could be significant and could reach the level of incidental take.

We have considered these potential sources of adverse effects to the listed species covered by your biological assessment. This consideration includes the information provided in the EA, and discussions with Corp personnel and other species experts.

Based on this information, the Service concurs with the Corp's determination that the proposed project, as described, will have no effect on the American peregrine falcon, bald eagle, Aleutian Canada goose, northern spotted owl, western snowy plover, tidewater goby, Oregon silverspot butterfly, western lily, and the Wolf's evening primrose. This concurrence is based on the following factors.

The peregrine falcon has no known nest sites within 2 miles of the proposed project, and the proposed project is not likely to have any affect on prey species' abundance or distribution, or on falcons foraging sites. The bald eagle has no known nest sites near the project, and is not expected to occur to occur at or near the construction site except as an occasional transient. The Aleutian Canada goose does not regularly roost or feed in or near the harbor site, staying mostly north of the project site on Castle Rock or near Lake Earl Wildlife Area and nearby farmlands. The northern spotted owl is a late-successional forest associated species; no suitable habitat occurs at or near the project site. The western snowy plover occurs on the north coast as an uncommon to rare nester and winter migrant. However, the species occurs mostly on wide open beaches, salt flats and occasional gravel bars. The species has been known to nest on dredge spoils (especially near Coos Bay, Oregon). However, the dredge spoils associated with the upland disposal site at Crescent City are much smaller in size, are not directly associated with ocean beaches, and are subject to significant disturbance from industrial development and recreational uses. The snowy plover is not expected to occur on these dredge spoils. The tidewater goby may occur in Elk Creek slough or lower stream reaches. The species is limited to estuarine habitats, where it nests in soft muds and sands in generally less that 1 m deep water. Although some sedimentation could occur as a result of hydraulic dredging, the project is expected to have no effect on gobies due to the distance from the potential source of sedimentation (0.5 mile) and the fact that goby habitat is likely to occur slightly upstream from any sediment deposition zone in Elk Creek slough above tidal influence. No suitable habitat for Oregon silverspot butterfly or its host species, *Viola adunca*, is known to occur on the project area.

The project is expected to have no effect on the western lily or Wolf's evening primrose, based on information provided in the EA. That assessment states that populations of these species do not occur on the disposal site, but acknowledges that these species do occur within the general

vicinity of Crescent City. The Corp will conduct additional surveys for these species on the upland disposal site. Should either of these species be found during the surveys, the Corp would reinitiate consultation with the Service and jointly develop appropriate conservation measures.

The marbled murrelet is a seabird that has adapted its nesting behavior to use large mature and old growth trees to nest in. Since no habitat of this type occurs near the project site, no effect to nesting habitat or behavior is anticipated. The species roosts and forages in near-shore marine waters, and could roost on the water or forage within the area of project influence. Since the species could be temporarily displaced from normal foraging or roosting sites, the Service does not concur with the Corp's determination that the project will have no effect on this species. However, since the likelihood of displacement of the species is low, the project duration is only several days, and the species is mobile, it likely that the level of risk of impacts to the species is insignificant. Therefore, the Service concludes that the project, as proposed, may affect, but is not likely to adversely affect, the marbled murrelet. In reaching this finding, the Service has not prescribed additional conservation measures or project modifications for the Corp to implement.

This consultation addresses only the American peregrine falcon, marbled murrelet, bald eagle, Aleutian Canada goose, northern spotted owl, western snowy plover, tidewater goby, Oregon silverspot butterfly, and western lily, and the Wolf's evening primrose. The Corps did not request consultation on other listed species in regards to this project. Also note that the anadromous fish species addressed under your EA are under the section 7 regulatory jurisdiction of the National Marine Fisheries Service.

No incidental take was requested for the proposed project, and none is authorized with this consultation. This concludes the informal consultation process. Unless new information reveals that the proposed action may affect listed species or critical habitat in a manner or to an extent not considered in your correspondence, the action is modified in a manner that causes an effect to the listed species or critical habitat not considered in your correspondence, or a new species or critical habitat is designated that may be affected by the proposed activity, no further action pursuant to the Act is necessary.

The Service thanks the Corp for their efforts to conserve listed species. If you have questions or concerns please contact Ray Bosch or David Solis of my staff (707 822-7201).

Sincerely,

Bruce Halstead

Bruce Halstead
Project Leader

cc:
NMFS, ATTN: D. Butler, Santa Rosa, California
FWS. ATTN: R. Brown, Arcata, California
FWS. ATTN: W. Amy, Sacramento, California

APPENDIX B

CRESCENT CITY HARBOR PROJECT
UPLAND DISPOSAL SITE
HABITAT EVALUATION PROCEDURES

INTRODUCTION

The ocean commercial fisheries industry is a major contributor to the economy of Crescent City, California. Currently, commercial fishing vessels experience navigational difficulties while gaining access to the Small Boat Basin in Crescent City Harbor due to shallow channel depths (Figure 1). Shoaling of the access channel forces boats to rely on tidal cycles to enter the Small Boat Basin. Additionally, problems occur as larger boats clog the entrance to the harbor, causing delays to all marine vessels, as they wait for the tides to come in. The access channel is currently maintenance-dredged by the local Harbor District, however, limited maintenance capabilities combined with periodic episodes of rapid shoaling in the access channel have not permitted efficient use of the harbor facilities.

There are two existing Federally-maintained navigation channels at Crescent City Harbor. The Entrance Channel begins at the outer breakwater and is 20 feet deep, 2,600 feet long, and 200 feet wide. This Entrance Channel connects to the Inner Harbor Channel which is 1,500 feet long and extends from the Entrance Channel along the lee side of the inner breakwater. The Inner Harbor Channel was originally authorized and historically maintained at -20 feet mean lower low water (MLLW) but this depth was reduced to -15 feet MLLW in 1993 due to lack of economic justification for continued dredging to the authorized depth.

The access channel from the Inner Harbor Channel to the Citizen's Dock and the Small Boat Basin is not a Federal project. The access channel was initially dredged to -16 feet MLLW and about 150 feet wide for access to the Small Boat Basin. However, this channel has never been maintained to -16 feet MLLW and, consequently, has shoaled in significantly.

The Board of Harbor Commissioners of the Crescent City Harbor District requested that the Corps of Engineers (Corps) conduct a Reconnaissance Study to determine the Federal interest in deepening and maintaining the currently non-Federal access channel to the Harbor District's Small Boat Basin and Citizen's Dock. The objective of the Corps' Reconnaissance Study is to investigate extending the existing Federal channel from the Inner Harbor Channel to the Citizen's Dock and the Small Boat Basin. The project would be designed to reduce direct delays to larger vessels due to low tides, and to other fishing boats using the facilities at the Citizen's Dock caused by the berthing of large boats that cannot enter the Small Boat Basin. The project would deepen the existing channel and transfer the maintenance of the channel from the Harbor District to the Federal Government.

DESCRIPTION OF HEP

HEP is a methodology developed by the Fish and Wildlife Service (Service) and other State and Federal resource and water development agencies which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed or anticipated land-use and water-use changes on habitat can be quantified. In a similar manner, any compensation needs (in terms of

acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific alternative mitigation sites.

A HEP application is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units

(HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparisons described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. Also, a user must be able to identify and measure the area of each distinct habitat being utilized by fish and wildlife species within the project area. Both the HSIs and the habitat acreages must also be reasonably estimable at various future points in time. The HEP team, comprised of Corps, California Department of Fish and Game (CDFG), and Service staff determined that these HEP criteria could be met, or at least reasonably approximated, for the Crescent City Harbor Navigation Project. Thus, HEP was considered an appropriate analytical tool to analyze impacts of the proposed project alternatives[1].

PROJECT DESCRIPTION

Dredged material from the Small Boat Basin Access Channel would be dredged and pumped via a pipeline to an existing permitted upland disposal site which is located adjacent to the Crescent City Harbor Boat Basin for drying. The Del Norte Solid Waste Management Authority has indicated a need for sandy material to cap their sanitary landfill and ultimately the dredged material may be trucked to the landfill after it has sufficiently dried.

This 7.1-acre[2] dredged material disposal site is owned and operated by the Crescent City Harbor District, who is the local sponsor for the proposed project. Currently, the site receives maintenance dredged materials from the Harbor annually. The remaining capacity of the site is about 15,000 cubic yards. The site would need to be emptied prior to construction of the project. The existing permit to use this site for dredged material disposal will expire in about 2 years. The Harbor District is pursuing renewal of the permit to continue use of this site.

METHODOLOGY

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[1] For further information on HEP, see ESM 100-104 which is available from the Service's Sacramento Fish and Wildlife Office.

[2] The HEP was originally run using a 6.1-acre disposal site. The site is now 7.1 acres, but the footprint is the same according to Corps documents. Since the preferred plan is to use the site only once for the initial dredging the HEP was not rerun.

The 1980 HEP procedures were used in this application which was conducted in the spring of 1996. The HEP field work was completed by staff from the Corps, CDFG, and the Service's Sacramento Ecological Services Field Office. Due to the distance between these offices and funding constraints, the Corps and CDFG representatives were unable to participate in all aspects of the subsequent data analysis, however.

The purpose of using HEP is to provide a quantitative basis for replacing the habitat values which would be degraded, destroyed, or created by project construction. Only one habitat type, upland, would be impacted by disposal of the wet dredged material. This assumes that all the permits needed to continue use of this site would be obtained.

Two HSI models were used in this HEP application to quantify the impacts of the proposed project on this habitat. These were the yellow warbler and savannah sparrow HSI models. These models were used to evaluate the impacts of the project because these species use upland habitat for foraging and reproduction. The yellow warbler represents species that utilize the shrubby vegetative component of uplands (thickets, willows) for foraging and reproduction. The yellow warbler is insectivorous, typically feeding among small limbs of deciduous foliage. Savannah sparrows forage and nest in grass-dominated habitat. Plant seeds and insects are the principle food items. The species is a ground nester, generally requiring dense grass or grass clumps and a well-developed litter layer in nesting habitat.

When using HEP, it is necessary to determine HSIs for each evaluation species at selected target years for both with-project and without-project scenarios. Proposed mitigation areas must be treated similarly (with-management is substituted for with-project conditions). The capacity of each sample site to meet the needs of the evaluation elements within the project impact and compensation areas was determined by the HEP team through measurement of specific habitat variables. Baseline values for each of the model variables was obtained by field sampling, aerial photograph and map interpretation, conversation with recognized experts, and review of existing records and reports. Table 1 lists the variables contained in each model and indicates how data for each variable was collected.

At the completion of data collection, an HSI value was calculated for each evaluation element yielding a rating on a scale of 0.0 to 1.0. The higher numerical rating is indicative of higher suitability for the evaluation element at the sample site. HSI measurements of the same habitat in an impact area were averaged. The HSI when multiplied by the area of the habitat yields HUs, a measure of the quality and quantity of the habitat. The equations used to calculate the HSIs are contained within each model (HEP Appendix 1).

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific

baseline Suitability Index[3] values for each evaluation species based on the HEP Team's best professional judgement of probable future conditions. The assumptions used to derive future HSI and acreage values for with- and without-project conditions on the impact and compensation areas are contained in HEP Appendix 2.

Table 1. Variables from the two Habitat Suitability Index models used in the Crescent City Harbor Navigation Project upland disposal site Habitat Evaluation Procedures.

HSI Model	HSI Variable	How Obtained
Yellow Warbler	V1 - Percent deciduous shrub cover	Field measurement
	V2 - Average height deciduous shrub cover	Field measurement
	V3 - Percent of deciduous shrub canopy comprised of hydrophytic shrubs	Field measurement
Savannah Sparrow	V1 - Percent cover of grass and grass-like plants	Field measurement
	V2 - Percent forb cover	Field measurement
	V3 - Percent litter cover	Field measurement
	V4 - Average height of grass and grass-like plants	Field measurement
	V5 - Average height of forbs	Field measurement
	V6 - Modal distance among shrubs and/or trees	Field measurement

Given these assumptions, long-term losses and gains in HUs can be estimated for each future scenario over the life of the project, then expressed as AAHU gains or losses. Basic HEP outputs, as expressed on Form Ds, are given in HEP Appendix 3. The HEP 2.2 Accounting Software Package was to calculate HUs, AAHUs, and the size of any compensation area needed to offset project impacts to fish and wildlife.

Lastly, in order to make the comparison of future with- and without-project conditions for each alternative described above, it was necessary to first develop the future without-project scenario for the habitats affected within the project area. This necessitated making several key assumptions. Among these were:

[3] A Suitability Index is the value obtained for each variable in a HSI model.

- the permits required to continue use of the proposed dredged material disposal site will be obtained.
- all dredged material placed on the disposal site from initial project construction will be eventually removed and utilized at approved upland sites.
- there are no outstanding mitigation requirements as a result of using this site for dredged material disposal.
- the site will be emptied prior to start of construction.
- the site, with or without the project, has a capacity of 3 years worth of maintenance dredging when empty.
- maintenance dredging will continue to occur annually at the harbor.

Given these conditions, a future without-project scenario was developed which was identical to the future with-project scenario (i.e., once the project is built, maintenance dredging activities will continue to occur annually).

RESULTS AND DISCUSSION

Given the assumptions above, most importantly that the existing permit for dredged material disposal at the site will be renewed, the results of the HEP indicate there will be no additional adverse impact when comparing the future with- and without-project. This is not unexpected, since essentially the same land use occurring now will be continued in the future. The major difference is the volume of dredged material that may be removed from the Harbor during maintenance activities will increase with the greater sized project.

Since there is no written assurance that the permit(s) required to continue use of this particular disposal site exist, a second scenario was run in the HEP. The purpose of this second HEP run was to estimate what the adverse impacts of using this site in the future for dredged material disposal would be from this project or future project activities, if the site was not permitted when construction begins. In this scenario the permitted use of the site was not renewed, but the initial dredging was completed prior to the expiration of the existing permit. The HEP was then rerun with an assumption that the site will develop improved upland habitat values once disposal activities on the site cease. The results of this second analysis indicate that the savannah sparrow and yellow warbler would have net losses of -2.97 and -3.87 AAHUs, respectively over the life of the project if the site is used for disposal in the future. These losses would need to be mitigated, however no specific analysis was performed to quantify this acreage. Since this scenario is still conceptual, it would be premature to identify specific impacts and mitigation needs until (1) it is clear how many years of habitat development would take place before disposal is renewed at the site, and (2) whether or not the site will actually be permitted. For mitigation planning purposes though, a compensatory mitigation ratio between 1 and 2:1 could be used.

At least two pieces of information are needed to do a thorough analysis of project impacts at the proposed upland disposal site. The first item needed is to validate the assumption that the permit(s) required for the continued use of the site will be easily obtained. The second item is to

verify if any outstanding compensatory or other mitigation measures, required in the existing permit, have not been implemented and maintained per requirements of the permit.

From a biological standpoint, the Service recognizes that the continued use of the existing site for dredged material disposal is preferred to developing another site with its associated impacts on fish and/or wildlife. This view could change, however, as additional information on the project and the disposal site are presented.

HEP APPENDIX 1
HABITAT SUITABILITY INDEX MODELS

HABITAT SUITABILITY INDEX MODEL

SAVANNAH SPARROW (*Passerculus sandwichensis*)

by

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento Field Office
Sacramento, California

1988

SAVANNAH SPARROW

General

The savannah sparrow (*Passerculus sandwichensis*) is a common breeding bird in low-elevation grasslands of the Pacific Northwest. It is found east and west of the Cascade Mountains in open fields, meadows, grain fields, and tidal marshes of pickleweed (*Salicornia virginica*) (Jewett et al. 1953; Larrison and Sonnenberg 1968). Birds have also been observed breeding in wet mountain meadows of the Cascades at 1890 m (6200 ft.) elevation (Banks 1960). Large numbers of savannah sparrows migrate through Washington and Oregon (Swarth 1936); migrants commonly range into mountainous areas seldom used for breeding (Larrison and Sonnenberg 1968; Wahl and Paulson 1971). Wintering birds are found west of the Cascades and favor grassy dunes and tidal marshes (Larrison and Sonnenberg 1968).

Food Requirements

Plant seeds and insects are the principle foods of the savannah sparrow. The percent plant food in the diet of sparrows collected throughout the geographic range was high in fall (84%) and winter (92%), moderate in spring (63%), and low in summer (26%) (Martin et al. 1961). Important food plants in California during spring and summer were bluegrass (*Poa* sp.), miner's lettuce (*Montia* sp.), pigweed (*Amaranthus* sp.), and chickweed (*Stellaria* sp.) (Martin et al. 1961). A wider diversity of plant seeds were consumed in fall and winter; species included knotweed (*Polygonum* sp.), turkey mullein (*Eremocarpos setigerus*), pigweed, wild oats (*Avena* sp.), canarygrass (*Phalaris* sp.), bluegrass, rabbitfoot polypogon (*Polypogon monspeliensis*), miner's lettuce, chickweed, and bromegrass (*Bromus* sp.). Crabgrass (*Digitaria* sp.) was the staple item in the diet of wintering savannah sparrows in South Carolina (Norris 1960). The major animal foods of this sparrow include beetles (Coleoptera), caterpillars (Lepidoptera), grasshoppers (Orthoptera), ants (Hymenoptera), bugs (Hemiptera), and flies (Diptera) (Martin et al. 1956). Spiders (Arachnida) and snails (Gastropoda) are taken locally. Insect prey taken by sparrows in Utah included leafhoppers (Cicadellidae), aphids (Aphididae), lygus bugs (Lygaeidae), damsel bugs (Nabidae), leaf beetles (Chrysomelidae), weevils (Curculionidae), midges (Chironomidae), and caterpillars (Knowlton 1950; Taber 1968). Dragonflies (Odonata), butterflies (Lepidoptera), aphids, spiders, and worms (Oligochaeta) were eaten by savannah sparrows in Wisconsin (Weins 1969). Larval and adult butterflies and moths were the main diet of savannah nestlings in Nova Scotia (Welsh 1975).

The savannah sparrow forages in the same grass-dominated cover types used for nesting. Individuals move slowly through the vegetation at about 0.3 m (1 ft.) per minute while foraging (Cody 1968). Sparrows on a Minnesota grassland spent 100% of their foraging time feeding on the ground and on vegetation within 7.6 cm (3 in.) of the surface (Cody 1968). Dense grass or grass clumps appear to be important components of foraging habitat for this species (Taber 1968). Wisconsin savannah sparrows restricted their foraging to areas of low grass cover having an average height of less than 10.2 cm (4 in.) (Wiens 1973). Concentrated feeding occurred around the perimeters of grass clumps.

Savannah sparrows on Destruction Island off the Washington coast spent 80% of their foraging time on a rockweed (*Fucus distichus*) substrate and the remaining 20% divided among substrates of barnacles (Cirripeda), gravel, sea lettuce (*Ulva* sp.), encrusting algae, mussels (*Mytilus* sp.), and sand (Nysewander 1977). Breeding savannah sparrows on a dune system in Nova Scotia foraged for nesting food within a dense cover of drifted eelgrass (*Zostera marina*) along a lagoon shore (Welsh 1975).

Foraging habitat for wintering birds is characterized by abundant small seeds available on the ground and by bare ground on which birds can move and forage (Quay 1957). Savannah sparrows will congregate around concentrated seed sources (Baird 1968). The density of wintering sparrows on a South Carolina field was correlated with the frequency of crabgrass on sample quadrats (Norris 1960). Sparrow density was 32.6 to 71.7 birds per ha (13.2 to 29.0 per acre) on areas with a crabgrass frequency of 77%, but was only 3.0 to 12.4 birds per ha (1.2 to 5.0 per acre) where crabgrass frequency was 9%.

Water Requirements

The savannah sparrow inhabits dry uplands and other areas such as sand dunes and salt marshes that lack sources of fresh water (Baird 1968). The species is able to subsist on moisture derived from dew and succulent food items (Cade and Bartholomew 1959). Fresh water is used for bathing and drinking when available (Norris 1960). Resident races of this species in salt marshes can utilize saline water to meet water requirements (Cade and Bartholomew 1959); Poulson and Bartholomew 1962). Other races, such as Brook's savannah sparrow (*P.s. Brooksi*) in the Pacific Northwest, use salt marshes mainly as wintering areas; these races have a low tolerance for salt water but can survive on brackish water.

Cover Requirements

Savannah sparrows roost on the ground among short grass (Baird 1968). Cover requirements during the breeding season are satisfied by moist open grassy fields with scattered forbs and a dense ground layer of grass and accumulated litter (Tester and Marshall 1961; Wiens 1973). Specific physical and vegetative characteristics of breeding habitat are described below under "Reproduction Requirements."

Wintering populations of savannah sparrows require an overhead cover of low to moderately tall grass (Quay 1957). Most wintering individuals on an Arizona grassland foraged between 4 and 16 m (13.1 and 52.5 ft.) from tree or shrub cover (Pulliam and Mills 1977). Relative density of savannah sparrows within this area was more than 3 times that of areas closer to or further from woody cover. Individuals usually flew to an exposed perch in herbaceous vegetation when first disturbed, but flew to cover if flushed a second time.

Reproduction Requirements

The savannah sparrow will nest in a variety of ecological situations, including prairie, freshwater marsh, sedge bog, cultivated field, coastal salt

marsh, grassy sand dune, and subalpine meadow (Baird 1968). This species was associated with the fescue-snowberry (*Festuca-Symphoricarpos*) plant community in the shrub-steppe region of eastern Washington (Johnsgard and Rickard 1957).

This species is a ground nester. Nests are usually placed in a shallow hollow among grass tussocks and low rank vegetation (Baird 1968; Taber 1968). Of 27 nests found on old fields in Wisconsin, 19 were either partially domed or well concealed beneath overhanging litter (Weins 1969). Nests on Nova Scotia coastal dunes were placed beneath grass tufts, under heavy crowberry (*Empetrum nigrum*) growth, and under clumps of reindeer moss (*Cladonia* sp.) (Welsh 1975).

Savannah sparrows generally require dense grass or grass clumps and a well-developed litter layer on nesting habitat (Taber 1968). A pasture in Michigan used for nesting was characterized by grass hummocks 30 cm (11.8 in.) high and other grasses up to 45 cm (17.7 in.) tall (Potter 1972). The average height of vegetation on nesting territories in Minnesota was 0.6 m (2.0 ft.) (Cody 1968). The average vertical density (number of contacts of vegetation on a thin metal bar held upright perpendicular to the ground) on these territories was 14.3, while the horizontal density of vegetation (number of contacts on a thin 0.9 m bar held parallel to the ground 5 cm above the surface) averaged 13.3. Other grasslands within the geographic range of the savannah sparrow but without breeding populations had vegetation less than 0.4 m (1.4 ft.) tall. The average vertical and horizontal densities were less than 8.0 and 8.7 respectively on these unoccupied grasslands. Portions of a Wisconsin pasture that were colonized in the early and middle stages of territory establishment had significantly more grass cover, deeper and patchier litter, and lower forb density and cover at the peak of the breeding season than areas of the pasture colonized during the late spring (Weins 1973). Grass cover ranged between 71 and 100% among all territories and averaged 96, 95, and 88% respectively on early-, middle-, and late-occupied territories. The corresponding average litter depths were 2.8, 2.4, and 1.8 cm (1.1, 0.9, and 0.7 in.). Forb cover on territories ranged between 15 and 42%; the averages on early-, middle-, and late-occupied territories were 18, 23, and 34% respectively. Average forb heights on these territory groups were 12, 16, and 18 cm (4.7, 6.3, and 7.1 in.). The density of forbs was low on the first territories established and high on later territories. Nest sites were located in areas with a litter cover of 100% (Weins 1969). The litter cover over entire nesting territories averaged 64%. The mean litter depth at nest sites was 7.8 cm (3.1 in.); most nests were located in litter more than 1 cm (0.4 in.) deep.

Special Habitat Requirements

Savannah sparrows require song and display perches within breeding territories. Weed stalks and fence posts were used for perching in the Pacific Northwest (Gabrielson and Jewett 1940) and Wisconsin (Weins 1973). Perch sites in Michigan included thistle (*Cirsium* sp.), goldenrod (*Solidago* sp.), willow (*Salix* sp.) clumps 0.5 to 2.0 m (1.6 to 6.6 ft.) high, barbed wire fencing, and the ground (Potter 1972). Small woody plants were used on sites where tall forbs were absent in southeastern Washington (Johnsgard and Rickard 1957) and Nova Scotia (Welsh 1975).

Interspersion Requirements

The savannah sparrow is an "herb sparrow" (Odum and Hight 1957). All its habitat requirements are satisfied by the herbaceous vegetation of grass-dominated cover types. No interspersion of woody vegetation is necessary.

Breeding territories in Michigan averaged 0.11 ha (0.27 acres) in area (Potter 1972). Territories with nests were larger (0.12 ha, 0.30 acres) than those without nests (0.08 ha, 0.20 acres). Territories ranged in size from 0.01 to 0.29 ha (0.02 to 0.72 acres), but 58% were between 0.06 and 0.12 ha (0.15 to 0.30 acres) in area. Breeding territories in a Wisconsin pasture ranged in area from 0.16 to 1.09 ha (0.40 to 2.69 acres) (Weins 1973). The mean size of territories on the center of the pasture was 0.45 ha (1.11 acres), while territories on the periphery averaged 0.65 ha (1.61 acres). Territories formed early in the breeding period were smaller (0.49 ha, 1.21 acres) than those established during the middle (0.53 ha, 1.31 acres) and late (0.57 ha, 1.41 acres) periods of territory formation. The size of individual territories on Nova Scotia sand dunes varied within the breeding season (Welsh 1975). The maximum mean territory size of 0.21 ha (0.53 acres) was reached immediately after clutch completion. After hatching a brood, sparrows defended a smaller feeding area averaging 0.15 ha (0.37 acres) in size. The territory size over the entire breeding period averaged 0.17 ha (0.42 acres) and ranged from 0.07 to 0.40 ha (0.17 to 0.99 acres).

The density of breeding birds on an old field in New Brunswick was 8.7 pairs per ha (3.5 per acre) (Dixon 1978). Nesting habitat on Nova Scotia coastal dunes supported 5.4 pairs per ha (2.2 per acre) (Welsh 1975). The density of savannah pairs was 3.7 per ha (1.5 per acre) on old fields in Michigan (Potter 1972). A density of only 2.5 territories per 10 ha (1 per 10 acres) was observed in southeaster Washington (Johnsgard and Rickard 1957).

Savannah sparrows move over a wide area during winter foraging activity. Short-term winter home ranges in South Carolina averaged 3.2 ha (8 acres) in area and ranged from 0.8 to 5.7 ha (2 to 14 acres) (Norris 1960). Individuals changed foraging areas frequently and the total area utilized during a winter season was larger than these home range sizes. Winter density on old fields averaged 9.9 to 12.3 birds per ha (4 to 5 per acre), while spring and fall densities were less than 4.9 birds per ha (2 per acre). Congregations of more than 74.1 birds per ha (30 per acre) occurred around concentrated food sources.

Special Considerations

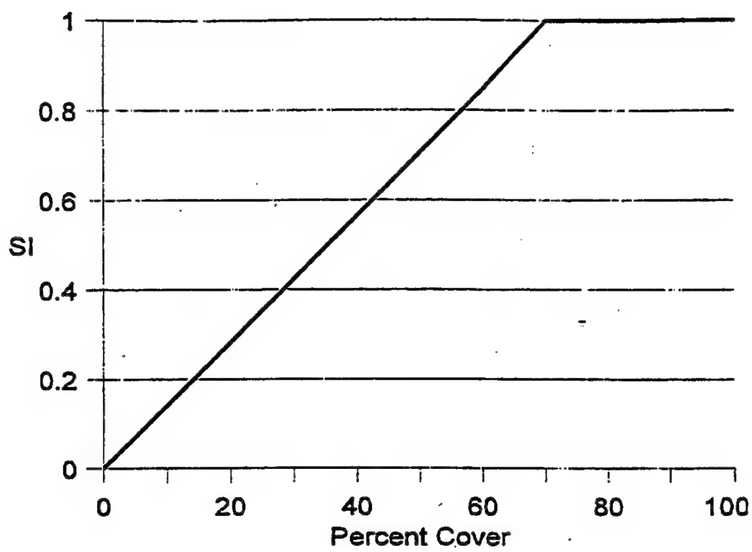
The savannah sparrow will readily utilize cultivated and hay fields in place of natural grasslands as breeding and wintering habitat. Heavy grazing eliminates nesting and cover habitat by reducing the height and density of herbaceous vegetation. The loss of natural salt marsh and dune communities to development reduces the area of suitable breeding and wintering habitat for coastal populations of this species. Relatively high pesticide levels have been found in savannah sparrows due to their insectivorous diet during the summer (Johnson 1975).

SAVANNAH SPARROW

Herbland
Herb-dominated wetland

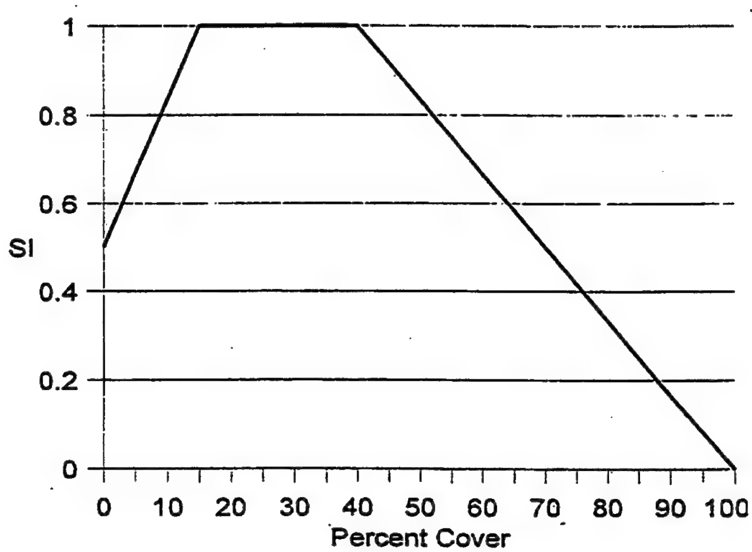
Habitat Requirement	Field Measurement
Food	Percent cover of grass and grass-like plants
Cover	Average height of grass and grass-like plants Percent forb cover Average height of forbs Percent litter cover Modal distance among shrubs and trees
Reproduction	Percent cover of grass and grass-like plants Percent forb cover Percent litter cover Average height of grass and grass-like plants Average height of forbs

Variable 1: Percent cover of grass and grass-like plants



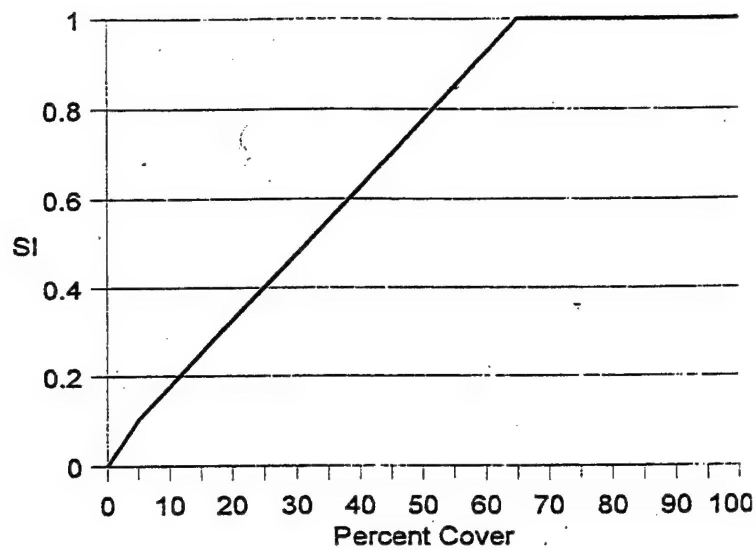
Assumes: Optimal graminoid cover in foraging areas and nesting ≥ 71 % (Wiens 1973).

Variable 2: Percent forb cover



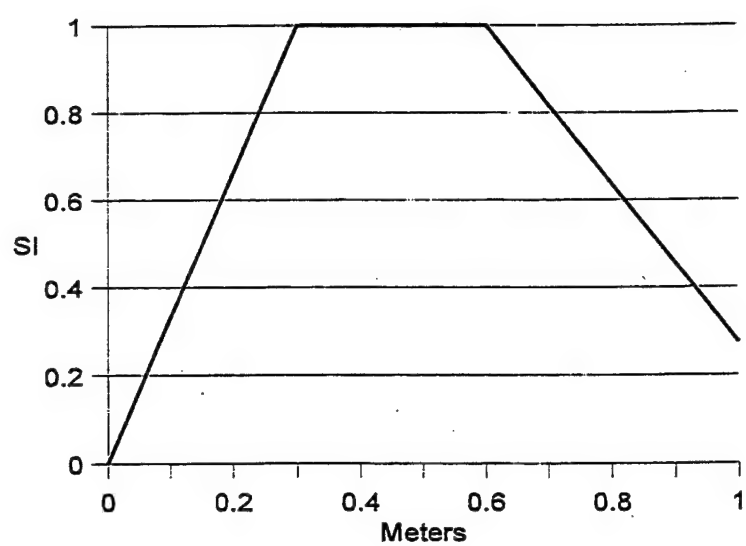
Assumes: Optimal forb cover on nesting territories is between 15 and 42 % (Wiens 1973).

Variable 3: Percent litter cover



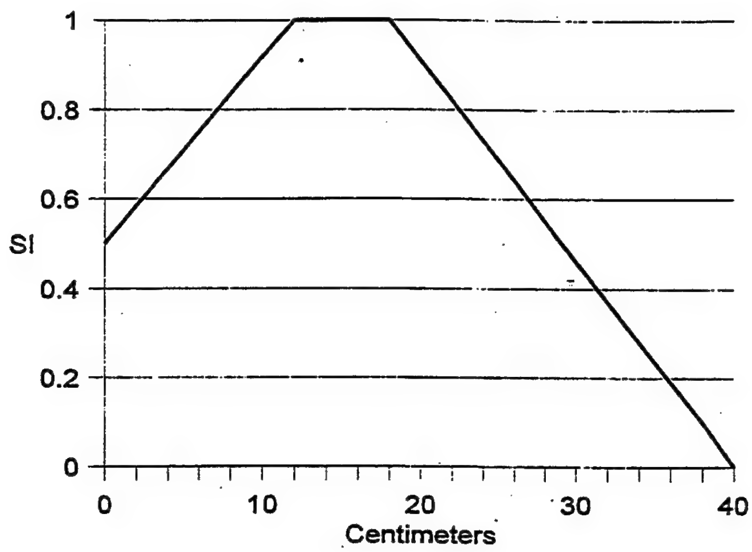
Assumes: Optimal litter cover on nesting territories is ≥ 64 % (Wiens 1969).

Variable 4: Average height of grass and grass-like plants



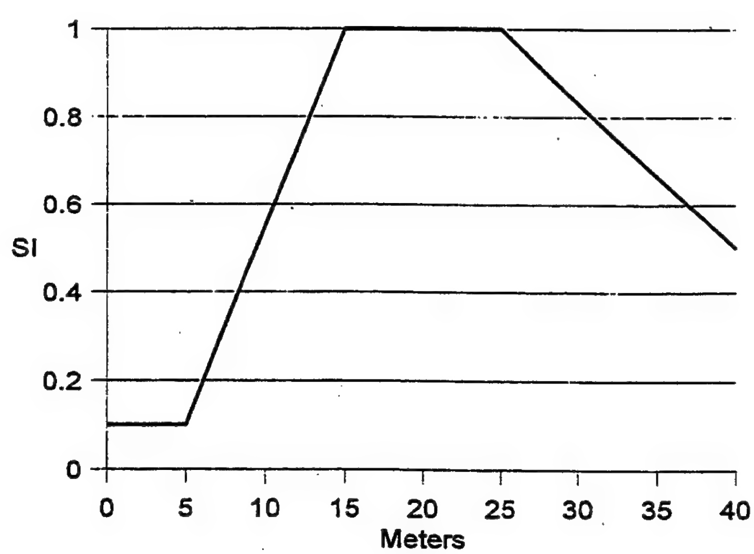
Assumes: Optimal height for cover and nesting ranges from 0.3 to 6.0 m (Cody 1968; Potter 1972).

Variable 5: Average height of forbs



Assumes: Optimal height of forbs on nesting territories is between 12 and 18 cm (Wiens 1973).

Variable 6: Modal distance among shrubs and/or trees



Assumes: Optimal foraging on winter habitat at 4-16 m from cover (Pulliam and Mills 1977), therefore the optimal spacing between cover patches is 20 m. Areas with shrubs and trees spaced closer than 4 m are not utilized by this species.

HSI Determination

$Food_{SI} = V1$

$$Cover_{SI} = \frac{V4 + V2 + V5 + V3 + V6}{5}$$

$$Reproduction_{SI} = \frac{V1 + V2 + V3 + V4 + V5}{5}$$

HSI = Lowest SI value

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FWS/OBS-82/10.27
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HABITAT SUITABILITY INDEX MODELS: YELLOW WARBLER

by

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

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YELLOW WARBLER (*Dendroica petechia*)

HABITAT USE INFORMATION

General

The yellow warbler (*Dendroica petechia*) is a breeding bird throughout the entire United States, with the exception of parts of the Southeast (Robbins et al. 1966). Preferred habitats are wet areas with abundant shrubs or small trees (Bent 1953). Yellow warblers inhabit hedgerows, thickets, marshes, swamp edges (Starling 1978), aspen (*Populus* spp.) groves, and willow (*Salix* spp.) swamps (Salt 1957), as well as residential areas (Morse 1966).

Food

More than 90% of the food of yellow warblers is insects (Bent 1953), taken in proportion to their availability (Busby and Sealy 1979). Foraging in Maine occurred primarily on small limbs in deciduous foliage (Morse 1973).

Water

Dietary water requirements were not mentioned in the literature. Yellow warblers prefer wet habitats (Bent 1953; Morse 1966; Stauffer and Best 1980).

Cover

Cover needs of the yellow warbler are assumed to be the same as reproduction habitat needs are discussed in the following section.

Reproduction

Preferred foraging and nesting habitats in the Northeast are wet areas, partially covered by willows and alders (*Alnus* spp.), ranging in height from 1.5 to 4 m (5 to 13.3 ft) (Morse 1966). It is unusual to find yellow warblers in extensive forests (Hebard 1961) with closed canopies (Morse 1966). Yellow warblers in small islands of mixed coniferous-deciduous growth in Maine utilized deciduous foliage far more frequently than would be expected by chance alone (Morse 1973). Coniferous areas were mostly avoided and areas of low deciduous growth preferred.

Nests are generally placed 0.9 to 2.4 m (3 to 8 ft) above the ground, and nest heights rarely exceed 9.1 to 12.2 m (30 to 40 ft) (Bent 1953). Plants used for nesting include willows, alders, and other hydrophytic shrubs and trees (Bent 1953), including box-elders (*Acer negundo*) and cottonwoods (*Populus* spp.) (Schrantz 1943). In Iowa, dense thickets were frequently occupied by yellow warblers while open thickets with widely spaced shrubs rarely contained nests (Kendeigh 1941).

Males frequently sing from exposed song perches (Kendeigh 1941; Ficken and Ficken 1965), although yellow warblers will nest in areas without elevated perches (Morse 1966).

A number of Breeding Bird Census reports (Van Velzen 1981) were summarized to determine nesting habitat needs of the yellow warbler, and a clear pattern of habitat preferences emerged. Yellow warblers nested in less than 5% of census areas comprised of extensive upland forested cover types (deciduous or coniferous) across the entire country. Approximately two-thirds of all census areas with deciduous shrub-dominated cover types were utilized, while shrub wetlands types received 100% use. Wetlands dominated by shrubs had the highest average breeding densities of all cover types [2.04 males per ha (2.5 acre)]. Approximately two-thirds of the census areas comprised of forested draws and riparian forests of the western United States were used, but average densities were low [0.5 males per ha (2.5 acre)].

Interspersion

Yellow warblers in Iowa have been reported to prefer edge habitats (Kendeigh 1941); Stauffer and Best 1980). Territory size has been reported as 0.16 ha (0.4 acre) (Kendeigh 1941) and 0.15 ha (0.37 acre) (Kammeraad 1964).

Special Considerations

The yellow warbler has been on the Audubon Society's Blue List of declining birds for 9 of the last 10 years (Tate 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model has been developed for application within the breeding range of the yellow warbler.

Season. This model was developed to evaluate the breeding season habitat needs of the yellow warbler.

Cover types. This model was developed to evaluate habitat in the dominant cover types used by the yellow warbler. Deciduous Shrubland (DS) and Deciduous Scrub/Shrub Wetland (DSW) (terminology follows that of U.S. Fish and Wildlife Service 1981). Yellow warblers only occasionally utilize forested habitats and reported populated densities in forests are low. The habitat requirements in forested habitats are not well documented in the literature. For these reasons, this model does not consider forested cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous that is required before an area will be occupied by a species. Information on the minimum habitat area for the yellow warbler was not located in the literature. Based on reported territory sizes, it is assumed that at least 0.15 ha (0.37 acre) of suitable habitat must be available for the yellow warbler to occupy an area. If less than this amount is present, the HSI is assumed to be 0.0.

Verification level. Previous drafts of the yellow warbler habitat model were reviewed by Douglass H. Morse and specific comments were incorporated into the

current model (Morse, pers. comm.).

Model Description

Overview. This model considers the quality of the reproduction (nesting) habitat needs of the yellow warbler to determine overall habitat suitability. Food, cover, and water requirements are assumed to be met by nesting needs.

The relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler is illustrated in Figure 1.

Figure 1. Relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler.

Habitat variable	Life requisite	Cover types	
Percent deciduous shrub crown cover			
Average height of deciduous shrub canopy	Reproduction	Deciduous Shrubland Deciduous Scrub/ Shrub Wetland	HSI
Percent of shrub canopy comprised of hydrophytic shrubs			

The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the yellow warbler and to explain and justify and variable and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables that will be used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

Reproduction component. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. Upland shrub habitats on dry sites will provide only marginal suitability.

It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero. Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be

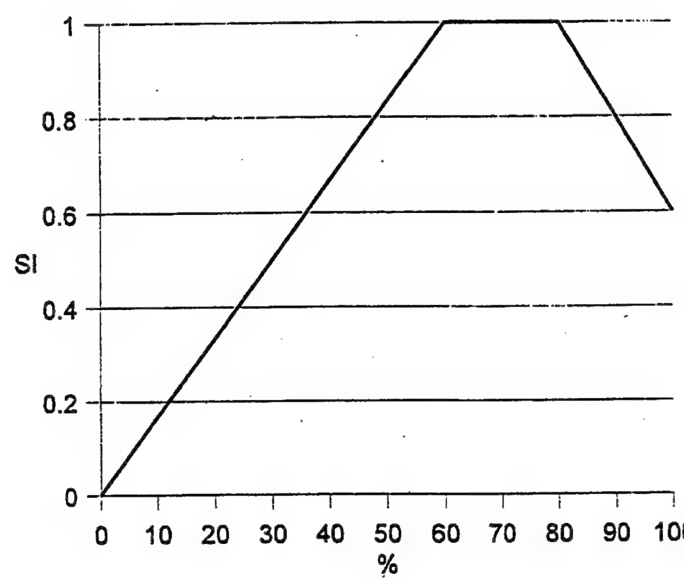
optimal, and suitability will decrease as heights decrease to zero.

Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitability. Low values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

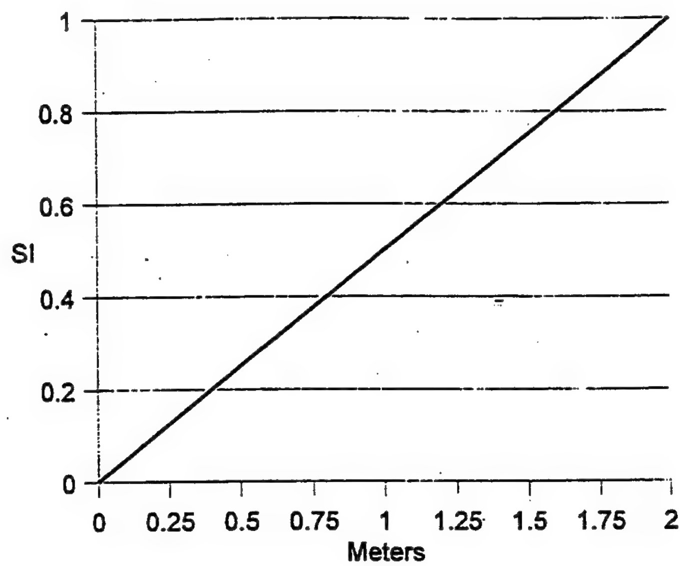
Model Relationships

Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

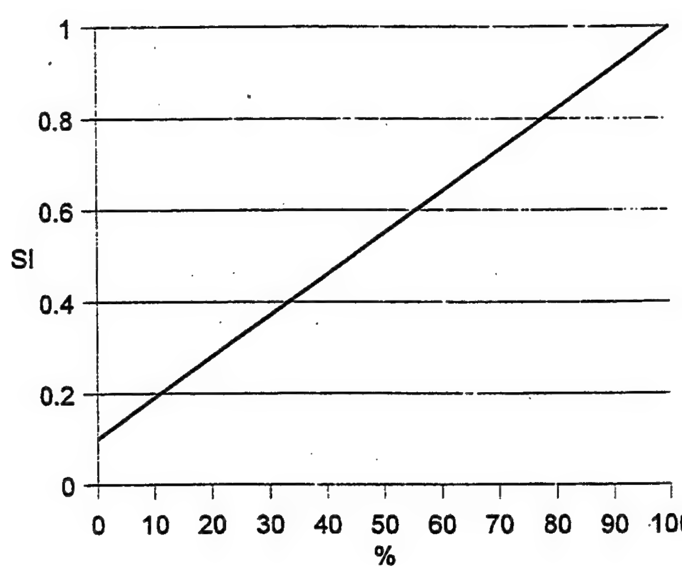
Cover-type		Variable
DS,DSW	V_1	**Percent deciduous shrub crown cover.**



DS,DSW V_2 Average height of deciduous shrub canopy.



DS, DSW V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs.



Equations. In order to obtain life requisite values for the yellow warbler, the SI values for appropriate variables must be combined with the use of equations. A discussion and explanation of the assumed relationship between variables was included under Model Description, and the specific equation in this model was chosen to mimic these perceived biological relationships as closely as possible. The suggested equation for obtaining a reproduction value is presented below.

Life requisite	Cover type	Equation
Reproduction	DS,DSW	$(V_1 \times V_2 \times V_3)^{1/3}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 2.

Figure 2. Definitions of variables and suggested measurement techniques.

Variable (definition)	Cover types	Suggested techniques
V_1 Percent deciduous shrub crown cover (the percent of the ground that is shaded by a vertical projection of the canopies of woody deciduous vegetation which are less than 5 m (16.5 ft) in height).	DS,DSW	Line intercept
V_2 Average height of deciduous shrub canopy (the average height from the ground surface to the top of those shrubs which comprise the uppermost shrub canopy).	DW,DSW	Graduated rod
V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs (the relative percent of the amount of hydrophytic shrubs compared to all shrubs, based on canopy cover).	DW.DSW	Line Intercept

SOURCES OF OTHER MODELS

No other habitat models for the yellow warbler were located.

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HEP APPENDIX 2
DATA ANALYSIS ASSUMPTIONS

CRESCENT CITY HARBOR NAVIGATION PROJECT
UPLAND DISPOSAL SITE HEP
UPLAND HABITAT

PA1 - Future Without the Project

Assumptions:
1. Site is permitted for use as a disposal site and permit will be renewed.
2. Disposal site needs to be emptied before project can be constructed (TY1).
3. Disposal occurs on the site annually from maintenance dredging.
4. Site has the capacity for 3 years of maintenance dredging.
5. Dried dredged materials will be moved from the site to suitable upland areas every 3 years.

Yellow Warbler

Variables: V1 - Percent deciduous shrub crown cover.
V2 - Average height of deciduous shrub canopy.
V3 - Percent of deciduous shrub canopy comprised of hydrophytic shrubs.

TY0 - Baseline (measured)

V1 - 0	SI = 0
V2 - 0	SI = 0
V3 - 0	SI = 0.1

HSI = $(V1xV2xV3)^{1/3}$
= $(0x0x0.1)^{1/3}$
= 0

TY1 - Disposal site is used for maintenance dredging

V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY4 - Disposal site is emptied and used for maintenance dredging. Site has capacity for 3 years maintenance dredging. Scenario continues for life of project.

V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY10 - V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY51 - V1 - no change
V2 - no change
V3 - no change

HSI = 0

Savannah Sparrow

Variables:
V1 - Percent cover of grass and grass-like plants.
V2 - Percent forb cover.
V3 - Percent litter cover.
V4 - Average height of grass and grass-like plants.
V5 - Average height of forbs
V6 - Modal distance among shrubs and/or trees

TY0 - Baseline (measured)

V1 - 34%	SI = 0.49
V2 - 1%	SI = 0.51
V3 - 10%	SI = 0.17
V4 - 4in (0.1m)	SI = 0.32
V5 - 3in (7.6cm)	SI = 0.80
V6 - 0	SI = 0.10

$Food_{SI} = V1 = 0.49$

$$Cover_{SI} = \frac{V4+V2+V5+V3+V6}{5} = \frac{0.32+0.51+0.80+0.17+0.10}{5} = 0.38$$

$$Reproduction_{SI} = \frac{V1+V2+V3+V4+V5}{5} = \frac{0.49+0.51+0.17+0.32+0.80}{5} = 0.46$$

HSI = Lowest SI = 0.38

TY1 - Disposal site is used for maintenance dredging.
V1 - no change
V2 - no change
V3 - no change
V4 - no change
V5 - no change
V6 - no change

$Food_{SI} = 0.49$
$Cover_{SI} = 0.38$ HSI = 0.38
$Reproduction_{SI} = 0.46$

TY4 - Disposal site is emptied and used for maintenance dredging. Site has capacity for 3 years maintenance dredging. Scenario continues for life of project.

V1 - no change
V2 - no change
V3 - no change

V4 - no change
V5 - no change
V6 - no change

HSI = 0.38

TY10 - V1 - no change
V2 - no change
V3 - no change
V4 - no change
V5 - no change
V6 - no change

HSI = 0.38

TY51 - V1 - no change
V2 - no change
V3 - no change
V4 - no change
V5 - no change
V6 - no change

HSI = 0.38

PA3 - Future With the Project

Assumptions:

1. Site is permitted for use as a disposal site and permit will be renewed.
2. Disposal site needs to be emptied before project can be constructed (TY1).
3. Disposal occurs on the site annually from maintenance dredging.
4. Site has the capacity for 3 years of maintenance dredging.
5. Dried dredged materials will be moved from the site to suitable upland areas every 3 years.

Yellow Warbler

Variables: V1 - Percent deciduous shrub crown cover.
V2 - Average height of deciduous shrub canopy.
V3 - Percent of deciduous shrub canopy comprised of hydrophytic shrubs.

TY0 - Baseline (measured)

V1 - 0 SI = 0
V2 - 0 SI = 0
V3 - 0 SI = 0.1

HSI = $(V1xV2xV3)^{1/3}$
= $(0x0x0.1)^{1/3}$
= 0

TY1 - Disposal site is used for maintenance dredging

V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY4 - Disposal site is emptied and used for maintenance dredging. Site has capacity for 3 years maintenance dredging. Scenario continues for life of project.

V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY10 - V1 - no change
V2 - no change
V3 - no change

HSI = 0

TY51 - V1 - no change
V2 - no change
V3 - no change

HSI = 0

Savannah Sparrow

Variables:
V1 - Percent cover of grass and grass-like plants.
V2 - Percent forb cover.
V3 - Percent litter cover.
V4 - Average height of grass and grass-like plants.
V5 - Average height of forbs
V6 - Modal distance among shrubs and/or trees

TY0 - Baseline (measured)

V1 - 34%	SI = 0.49
V2 - 1%	SI = 0.51
V3 - 10%	SI = 0.17
V4 - 4in (0.1m)	SI = 0.32
V5 - 3in (7.6cm)	SI = 0.80
V6 - 0	SI = 0.10

$Food_{SI} = V1 = 0.49$

$$Cover_{SI} = \frac{V4+V2+V5+V3+V6}{5} = \frac{0.32+0.51+0.80+0.17+0.10}{5} = 0.38$$

$$Reproduction_{SI} = \frac{V1+V2+V3+V4+V5}{5} = \frac{0.49+0.51+0.17+0.32+0.80}{5} = 0.46$$

HSI = Lowest SI = 0.38

TY1 - Disposal site is used for maintenance dredging.

V1 - no change
V2 - no change
V3 - no change
V4 - no change
V5 - no change
V6 - no change

$Food_{SI} = 0.49$
$Cover_{SI} = 0.38$ HSI = 0.38
$Reproduction_{SI} = 0.46$

TY4 - Disposal site is emptied and used for maintenance dredging. Site has capacity for 3 years maintenance dredging. Scenario continues for life of project.

V1 - no change
V2 - no change
V3 - no change
V4 - no change HSI = 0.38
V5 - no change
V6 - no change

TY10 - V1 - no change
V2 - no change
V3 - no change
V4 - no change HSI = 0.38
V5 - no change
V6 - no change

TY51 - V1 - no change
V2 - no change
V3 - no change
V4 - no change HSI = 0.38
V5 - no change
V6 - no change

UPLAND HABITAT

PA2 - Future Without the Project

Assumptions: 1. Existing permit is not renewed.
2. No dredged material disposal occurs.

Yellow Warbler

Variables: V1 - Percent deciduous shrub crown cover.
V2 - Average height of deciduous shrub canopy.
V3 - Percent of deciduous shrub canopy comprised of hydrophytic shrubs.

TY0 - Baseline (measured)

V1 - 0	SI = 0
V2 - 0	SI = 0
V3 - 0	SI = 0.1

$$HSI = (V1xV2xV3)^{1/2}$$
$$= (0x0x.1)^{1/2}$$
$$= 0$$

TY1 - No dredged material disposal

V1 - no change	SI = 0
V2 - no change	SI = 0
V3 - no change	SI = 0.1

HSI = 0

TY4 -	V1 - 10%	SI = .17
	V2 - 1.25m	SI = 0.6
	V3 - 100%	SI = 1.0

$$HSI = (.17x0.6x1.0)^{1/2}$$
$$= (.10)^{1/2}$$
$$= .32$$

TY10 -	V1 - 30%	SI = .51
	V2 - 1.5m	SI = 0.7
	V3 - no change	SI = 1.0

$$HSI = (.51x0.7x1.0)^{1/2}$$
$$= (.36)^{1/2}$$
$$= .60$$

TY51-	V1 - 40%	SI = .68
	V2 - >2m	SI = 1.0
	V3 - no change	SI = 1.0

$$HSI = (.68x1.0x1.0)^{1/2}$$
$$= (.68)^{1/2}$$
$$= .82$$

Savannah Sparrow

Variables:
- V1 - Percent cover of grass and grass-like plants.
- V2 - Percent forb cover.
- V3 - Percent litter cover.
- V4 - Average height of grass and grass-like plants.
- V5 - Average height of forbs
- V6 - Modal distance among shrubs and/or trees

TY0 - baseline (measured)

V1 - 34%	SI = 0.49
V2 - 1%	SI = 0.51
V3 - 10%	SI = 0.17
V4 - 0.1m)	SI = 0.32
V5 - 7.6cm	SI = 0.80
V6 - 0	SI = 0.10

$Food_{SI} = V1 = 0.49$

$$Cover_{SI} = \frac{V4+V2+V5+V3+V6}{5} = \frac{0.32+0.51+0.80+0.17+0.10}{5} = 0.38$$

$$Reproduction_{SI} = \frac{V1+V2+V3+V4+V5}{5} = \frac{0.49+0.51+0.17+0.32+0.80}{5} = 0.46$$

TY1 - No dredged material disposal occurs

V1 - no change	SI = 0.49
V2 - no change	SI = 0.51
V3 - no change	SI = 0.17
V4 - no change	SI = 0.32
V5 - no change	SI = 0.80
V6 - no change	SI = 0.10

$Food_{SI} = 0.49$
$Cover_{SI} = 0.38$
$Reproduction_{SI} = 0.46$

HSI = 0.38

TY4 -

V1 - 90%	SI = 1.0
V2 - 10%	SI = 0.84
V3 - 30%	SI = 0.46
V4 - .5m	SI = 1.0
V5 - 15cm	SI = 1.0
V6 - 40m	SI = 0.5

$Food_{SI} = 1.0$

$$Cover_{SI} = \frac{1.0+0.84+1.0+0.46+0.50}{5} = 0.76$$

$$Reproduction_{SI} = \frac{1.0+0.84+0.46+1.0+1.0}{5} = 0.86$$

HSI = 0.76

TY10	V1 - 70%	SI = .99
	V2 - 20%	SI = 1.0
	V3 - 40%	SI = 0.61
	V4 - no change	SI = 1.0
	V5 - no change	SI = 1.0
	V6 - 25m	SI = 1.0

$\text{Food}_{SI} = 0.99$

$$\text{Cover}_{SI} = \frac{1.0+1.0+1.0+0.61+1.0}{5} = 0.92$$

$$\text{Reproduction}_{SI} = \frac{.99+1.0+0.61+1.0+1.0}{5} = 0.92$$

HSI = 0.92

TY51	V1 - 60%	SI = 0.86
	V2 - no change	SI = 1.0
	V3 - no change	SI = 0.61
	V4 - no change	SI = 1.0
	V5 - no change	SI = 1.0
	V6 -15m	SI = 1.0

$\text{Food}_{SI} = 0.86$

$$\text{Cover}_{SI} = \frac{1.0+1.0+1.0+0.61+1.0}{5} = 0.92$$

$$\text{Reproduction}_{SI} = \frac{0.86+1.0+0.61+1.0+1.0}{5} = 0.89$$

HSI = 0.89

HEP APPENDIX 3
FORM D
(Net Change in AAHUs)

UPLAND DISPOSAL

Form D: Net Change in AAHUs

Date: 04/17/1996

Study Name: CRESCENT CITY HARBOR NAVIGATION PROJECT

Action:	PA3	(with project)	Upland With Project
Compared to:	PA1	(without project, permit renewed)	Upland Without Project

Period of analysis: 51

Evaluation Species ID# Name	AAHUs With Action	AAHUs Without Action	Net Change
1. SAVANNAH SPARROW	2.32	2.32	0.00
2. YELLOW WARBLER	0.00	0.00	0.00

Form D: Net Change in AAHUs

Date: 04/17/1996

Study Name: CRESCENT CITY HARBOR NAVIGATION PROJECT

Action:	PA3	(with project)	Upland With Project
Compared to:	PA2	(without project, no new permit)	Upland Without Project

Period of analysis: 51

Evaluation Species ID# Name	AAHUs With Action	AAHUs Without Action	Net Change
1. SAVANNAH SPARROW	2.32	5.29	-2.97
2. YELLOW WARBLER	0.00	3.87	-3.87

APPENDIX C

CRESCENT CITY HARBOR PROJECT
SMALL BOAT BASIN ACCESS CHANNEL
HABITAT EVALUATION PROCEDURES

APPENDIX C

HABITAT EVALUATION PROCEDURES FOR THE SMALL BOAT BASIN ACCESS CHANNEL

A. Summary of Alternative

The proposed alternative would deepen the existing access channel between the Inner Harbor Channel past the Citizen's Dock to the Small Boat Basin. This channel is about 1,200 feet long and 150 feet wide. Though originally dredged to -16 feet MLLW, it is currently maintained on an as-needed basis to a minimum of -12 feet MLLW, although it is deeper in places. With the project, the channel would be deepened to -15 feet MLLW (14 feet plus 1 foot overdepth), and would be maintained at this depth on a 2-year maintenance cycle. The base area of the channel is assumed to remain the same.

B. Methods

For the area to be dredged, we used the same approach as was applied for our analyses of the Oakland and Richmond Harbor Navigation Projects (USFWS 1994, 1996). The approach is to establish an aggregate HSI which represents our best professional opinion about the overall value of the habitat under with- and without-project conditions. Assignment of the HSI takes into account a variety of factors which can affect habitat value, such as (a) depth-related factors like contaminant accumulation and biological productivity, (b) physical disruption due to initial project construction, including changes in surrounding water quality, (c) increases or decreases in the frequency of maintenance dredging, and (d) increases or decreases in the level of shipping activity.

1. Impact Area – (a) *Subtidal Benthic*: These areas were separated in three categories: previously dredged, or existing channel base, previously dredged existing channel sideslope, and previously undredged, or new channel sideslope. Although the channel base for the proposed project is the same as the existing channel, the 1V:3H design sideslope requires some widening of the top of slope due to deepening of the channel. For the existing channel, we determined the base area to be about 4.40 acres. We estimated the average depth of the channel base to be -14 feet MLLW, and the depth of surrounding undredged areas to be about -10 feet MLLW. Assuming a 1V:3H sideslope would mean there is 12 feet of sideslope border between the base and top of slope. The total existing channel sideslope area of the existing channel is estimated to be about 0.60 acres (2,173 feet channel perimeter X 12 feet / 43,560 square feet per acre = 0.60 acres). For the proposed project, we assumed an initial depth of -15 feet MLLW (i.e., 14 feet plus one foot overdepth), one foot deeper than the average depth. With a 3:1 sideslope, this would add 3 feet at the top of slope to the affected area. This area is considered new dredging, and is estimated at 0.15 acres of new channel sideslope (2,173 feet channel perimeter X 3 feet / 43,560 square feet per acre = 0.15 acres), which applies to the project life of 50 years. This 0.15 acres is new channel near the top of slope as is treated separately in the HEP, below.

(b) *Water Column*: During dredging, sediment and any associated contaminants are dispersed to some degree to the overlying waters beyond the extent of the channels. Demonstration studies by the Corps (McLellan et al. 1989) indicate that hydraulic cutterhead pipeline dredging, such as is proposed for the access channel at Cresent City Harbor, results in very minimal resuspension into the water column, although it does create an elliptical plume of between 200 and 800 feet wide where the suspended sediment concentration is 2 to 4 times above background. On the other hand, the bucket

clamshell method currently used to maintain the harbor is much less efficient at containing sediments. The Black Rock Clamshell Demonstration (McLellan et al. 1989) suggested a plume of about 25 acres, whereas the Calumet Harbor Field Study indicated a plume for the hydraulic cutterhead could be as small as 1 acre. We assume that clamshell dredging would continue under existing conditions, and cutterhead dredging would be used under with-project conditions. We estimate the areas of water column impacted by the sediment plume to be 2 acres with-project (construction and maintenance) and 10 acres without-project (maintenance only).

2. Habitat Suitability Indices -- The assigned aggregate HSIs were based on the following assumed conditions resulting from project construction:

Vessel Traffic: Currently, boats with drafts of 11 feet or more would experience delays and some larger boats would be effectively excluded. Construction of the project could result in some increase in vessel traffic through the access channel, as it would permit boats with drafts up to 14 feet. A very modest increase in disturbance of sediments is possible with the project.

Maintenance -- (a) Without Project: The history of maintenance of the existing access channel is not precisely known. We assume that it is done annually, but is restricted to those areas which shoal to depths less than -12 feet MLLW. The shoaling areas identified by the Corps (1995, their Plate 4) are assumed to require annual maintenance, and constitute about a third of the total channel area. The remainder of the area would shoal less rapidly, but would eventually require maintenance. (b) With Project: Corps staff have indicated that maintenance dredging would occur once every 2 years. In addition to the more regular maintenance, the deeper access channel would accumulate somewhat more sediment than at present. The Corps estimates that an average of 16,000 cubic yards of dredged material per biennial maintenance cycle would be removed for a project depth of 14 feet. Overall, while the frequency of maintenance is reduced, the intensity of maintenance is increased, owing in part to the increased depth of the project and resultant increase in shoaling.

Depth-related processes -- As near-shore channels are deepened, their biological value is diminished due to a variety of mechanisms. With increasing depth, deposition of sediments and harbor-associated contaminants (if present) will also increase. Light is attenuated with increasing depth, which may result in reduced benthic productivity. The depth of the access channel of Crescent City Harbor, however, is already too deep for eelgrass, and none is present in the shallower shoaling areas.

The sediments of the access channel have not been characterized but probably resemble those of the Inner Harbor channel; sediments which have somewhat elevated pthalates, slightly elevated tin, and variably elevated sulfide levels. Oil and grease was present in only one of three composites. Based on this information, we conclude that the sediments are relatively uncontaminated and, while boating traffic could increase somewhat, it would not result in a severe degradation of sediment or water chemistry.

The mud layer is underlain by rock at about -15 feet MLLW. Thus, as depth of the channel is increased, this soft-bottom is replaced by a rock bottom or, at least, a subtidal mud bottom of limited thickness. This would likely result in a reduction in habitat value for the evaluation species.

(a) *Subtidal Benthic*: For the existing channel, without the project (existing condition, and TY0), we assigned a constant HSI of 0.65, indicative of a modest intensity of annual maintenance. During construction of the project (TY1), the HSI is reduced to 0.3, taking into account the increase in depth,

and the removal of soft-bottom subtidal muds near to the underlying rock. The disturbance during maintenance is assumed to be the same as during construction. We assume that recovery would take about a year but would not be complete; every other year, the channel would be dredged to a Federal standard of -15 feet MLLW (14 feet plus 1 foot overdepth), and the channel would not be dredged during intervening years. Therefore, for these years of maintenance (TYs 3, 5, 7 etc), we assigned an HSI of 0.3 (equivalent to the construction period), and for years following maintenance (TYs 2, 4, 6, etc.) we assign an HSI of 0.5. To simplify data entry, we entered a constant average HSI of 0.4 for TYs 1-51, which is the mean alternating maintenance (or construction) years and non-maintenance years.

For the existing channel sideslope areas, we also assigned a without-project HSI of 0.65, but because it has a thicker soft-bottom layer with the project, the HSI is reduced to 0.45 during construction or maintenance years, recovering to 0.60 during non-maintenance years. To simplify data entry, we entered a constant average HSI of 0.52 for TYs 1-51, which is the mean of HSIs for alternating maintenance (or construction) years and post-construction, non-maintenance years.

For the new channel sideslope areas, we assigned a without-project HSI of 0.70 because these areas would not be subject to dredging currently, and the same with-project HSI of 0.55 as described above for existing channel sideslope.

(b) *Water Column*: Without the project (existing condition, and TY0), a high HSI of 0.8 is assigned, taking into account the small vessel size, suspected minimal discharge of pollutants into the harbor, and annual maintenance using the clamshell dredge. As discussed above, this method tends to degrade water quality more severely than the cutterhead dredge. For with-project conditions during either the construction year or maintenance years (one out of every 3 years), we used an area weighted average of 0.84, which assumes an HSI of 0.6 within the 2 acre plume and 0.9 within the surrounding 8 acres of the evaluation area. To simplify data entry, we used a 3-year running average of the area-weighted average HSI of 0.87 (i.e., alternating non-maintenance years at an HSI of 0.9 and maintenance years at an HSI of 0.84) for TY1-51.

C. Results

We estimate a loss of -1.09 AAHUs of subtidal benthic habitat value would occur due to construction and maintenance of the access channel, compared with existing conditions (Table 1). At the same time, we expect a modest gain in water column habitat value of 0.69 AAHUs, a result which can be attributed to the use of a less dispersive dredging method.

In our recent evaluation of larger navigation projects for the more industrialized harbor Ports of Richmond and Oakland, we have recommended mitigation for *all* harbor impacts, including cover-types in resource categories 3 and 4. The rationale for doing so is several-fold: first, to encourage the maximum benefical re-use of dredged material for habitat purposes such as wetland creation, or levee reinforcement around agricultural wetlands, second to compensate the extensive cumulative impacts of all dredging activities around San Francisco Bay, and third, such a recommendation acknowledges the severe degradation associated with large-scale harbor operations. The proposed access channel in Crescent City Harbor differs from the larger projects. Opportunities for beneficial re-use for habitat purposes have not been identified for this area. The proposed activity would not result in extensive industrialization or risks associated with offloading activities, and there is no substantial contamination of the harbor compared to reference areas. Also, the proposed project does

not contribute to large cumulative impacts within the region. Finally, the calculated loss of habitat values are minimal and restricted to a very small area (about 5.15 acres of subtidal benthic habitat and 2 acres of water column habitat). Accordingly, we do not recommend mitigation for impacts of construction of the access channel at this time.

Table 1. Aggregate Habitat Suitability Indices (HSIs) by Target Year (TY) for with-project conditions and calculated Average Annualized Habitat Units (AAHUs) for subtidal benthic and water column at the dredging site of the Crescent City Harbor Access Channel. Without-project HSIs were assumed to remain as shown in TY0.

Cover-type		HEP input parameter	
		TY0	TY1-51
Subtidal Benthic (existing channel)	acres	4.40	4.40
	HSI	0.65	0.40
Subtidal Benthic (existing channel sideslope)	acres	0.60	0.60
	HSI	0.65	0.52
Subtidal Benthic (existing channel sideslope)	acres	0.15	0.15
	HSI	0.70	0.52
Water Column	acres	10.00	10.00
	HSI	0.80	0.87

	AAHUS		
	Without Project	With Project	Net Change
Subtidal Benthic (all categories)	3.35	2.16	-1.09
Water Column	8.00	8.69	0.69

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APPENDIX D
CRESCENT CITY HARBOR PROJECT
OPEN OCEAN DISPOSAL SITE
HABITAT EVALUATION PROCEDURES

APPENDIX D

HABITAT EVALUATION PROCEDURES FOR DISPOSAL OF DREDGED MATERIAL FROM THE DEEPENING OF CRESENT CITY HARBOR AT OCEAN DISPOSAL SITE SF #1

A. Summary of Alternative

The ocean site is an interim site designated by the United States Environmental Protection Agency (USEPA) and is known as SF #1. It is about 0.2 square miles in size, and located 1.3 miles south of the Crescent City Harbor in about 90 feet of water. Since the late 1970s, the site has been used for disposal of material from the Federal Crescent City Inner Harbor Channel and possibly the non-Federal Access Channel as well; detailed accounts of use and volume are unavailable. According to the Environmental Assessment included in the Corps' Reconnaissance Report (Corps 1995), overall shoaling of the channels is estimated at around 80,000 to 100,000 per year. The Corps has recently revised the expected quantities for excavation and maintenance of the small boat basin access channel that is the subject of this HEP. Deepening and maintenance of the access channel will result in a need to dispose of additional dredged material, estimated to be not more than 6,070 cy for project construction (Federal and non-Federal) and 8,000 per year for project maintenance (16,000 cy every 2 years). For the preferred alternative, the additional maintenance material would be disposed at SF #1 following the third maintenance dredging cycle (i.e., eight years after project construction). We assume that Crescent City Harbor is the sole source of material which would be disposed at this site. The construction and maintenance material from the first three cycles are assumed be disposed at the Harbor District's nearshore upland site.

B. Methods

We have previously evaluated ocean disposal alternatives for Richmond and Oakland Harbors at the SF-DODS, a USEPA-designated site in deep water west of the Golden Gate (USFWS 1994, 1996). The designation process involves a careful accounting of the site characteristics, and changes resulting from disposal (USEPA 1993). Although detailed information has not yet been developed for SF #1, we evaluated the results of past characterization of the site and bioassay information of the effects of Crescent City dredged material on marine invertebrates and fish (EA 1980, Toxscan 1993). These studies were done nearby, but not within, the access channel location.

Because of the shallower waters of SF #1, only two cover-types were analyzed for this site: open surface waters and deepwater benthos. The model we applied is a version used previously for Richmond Harbor (USFWS 1996), and consists of three community-based Suitability Indices (or SIs) which are assigned for each cover-type, then averaged to obtain the Habitat Suitability Index (HSI). These SIs are: (1) X1 - use of the habitat by the evaluation species, where the extent of use is ranked relative to the observation of such species within the impact area compared to other habitats within the species' population range; (2) X2 - overall community diversity; and (3) X3 - the evaluation species' commercial and/or recreational value.

For consistency with HEP, we have used the standard 0.0 to 1.0 range for each SI. The impact areas and SIs were estimated using our best professional biological judgement of the physical changes and resource responses anticipated due to disposal. These were based on our review of available information about the site and its characteristics, and are explained below:

(1) Impact area -- The impact area at an ocean disposal site depends greatly on the composition of the dredged material as well as the depth of the site; the impact area increases with increasing depth and with increasing proportion of silts. Materials such as sands or consolidated clays (such as encountered in clamshelled material) settle quickly and do not affect as large an area.

(a) *Open Surface Waters* -- For the SF-DODS, USEPA (1993) estimated that the surface area immediately impacted by open ocean barge release is a circular slab about 100 meters in diameter (1.9 acres), but this expands quickly within the upper 50 feet to a circle about 4 times the original diameter (31.1 acres). We used 31 acres as the impact area for this cover-type.

(b) *Deepwater Benthos* -- The shallow depth of SF #1, and the coarse texture of the dredged material suggest a predominance by sands, a material which would settle quickly to the bottom with little lateral dispersal. Information is not sufficient to determine if the material once settled would remain in place or would disperse over time. For this analysis, we assume that the impact area is equivalent to the area of the site (0.2 square miles, or 128 acres). We assume that the barge would be allowed to release material anywhere within the 128 acres, and that the dredged material would not move outside the site.

(2) Habitat Suitability Indices

The HEP input evaluated two with-project periods (a) from Target Year (TY) 0-8, which would be the same as without-project conditions because maintenance material is to be disposed elsewhere, and (b) TY9-51, in which additional maintenance material would be disposed at SF#1 beginning with the fourth maintenance cycle. In practice, the HSI would fluctuate because maintenance is done every other year; therefore, to simplify the HEP we evaluated a constant HSI for TY9-51 which reflects the average of maintenance and non-maintenance years.

(a) *Open Surface Waters* -- X1: Impacts on the surface waters would be relatively minor and temporary in nature. Both liquid and suspended particulate phase bioassays using a common zooplanton species, *Calanus pacificus*, did not detect significant mortality due to exposure dredged material (EA 1980). We estimate the additional material produced by the project to represent not more than 6 barge loads during the maintenance interval of every other year. There would probably be very slightly less wildlife use (birds and marine mammals) due to a increase in frequency disposal operations, every 2 years. We assigned values of 0.85 without the project, declining slightly to 0.84 with the project beginning at TY9.

X2: The diversity of fish and wildlife in the open surface waters would probably not be significantly impacted because disposal affects such a limited area and recolonization is expected to be rapid (SI = 0.6 with and without the project).

X3: Avoidance of the site probably would occur during without-project (existing) disposal operations, though mixing with surrounding waters should rapidly return the site to the same as surrounding areas. The additional disposal with the project would incrementally increase this avoidance to a very slight degree (SI = 0.95 without the project and 0.94 with the project beginning at TY9).

(b) *Deepwater Benthos* -- X1: Impacts on the benthos would be approximately proportionate to the dredge material volume disposed. As a long-term average, we estimate that a maximum of 100,000 cy per year would be dredged without the project (maintenance only, equivalent to the upper range of

shoaling estimated by the Corps). With the project, we estimate dredged material disposal volumes to increase by an additional 16,000 cy per maintenance cycle (annual average of 108,000 cy, beginning with the fourth maintenance cycle at TY9). We assume that the dredging for the construction or maintenance of the access channel would occur during a relatively compressed schedule of a few weeks. If current disposal (assumed to be about 33 barge loads) were to take place over a 3 month period, there would be about 5 or 6 additional barge loads over this period affecting the site due to the project (assuming 3,000 cy per barge load). This added disposal activity could slightly reduce habitat value during and following this disposal period. Toxicity tests of this dredged material using a variety of benthic organisms showed virtually no significant impacts in liquid, suspended particulate, or solid phase bioassays, and no bioaccumulation was seen for tests with the sea cucumber (EA 1979, Toxscan 1993). Use of the site by the evaluation species would be incrementally reduced due to burial of forage organisms. We estimate an SI of 0.8 without the project, declining to 0.76 with the project, beginning at TY9.

X2: The diversity of fish and invertebrates in the benthos would probably not be significantly impacted because disposal affects such a limited area and recolonization is expected to be rapid (SI = 0.6 with and without the project).

X3: Commercial/recreational value of the area is expected to be relatively high owing to the shallow depth, which is adequate for crabbing, sport fishing, or commercial trawling. Demersal fish and invertebrates would probably avoid the disposal site, seeking undisturbed surrounding areas for considerable periods following disposal, and the added disposal from the project construction and maintenance would constitute a slight increase over current disposal operations. We assigned SIs of 0.70 without the project, and 0.67 with the project.

C. Results and Discussion

As shown in Table 1, we estimate a combined loss of 2.4AAHUs (2.1 AAHUs of deepwater benthic value and 0.3 AAHUs of open surface water value) due to disposal of dredged materials from construction and maintenance of the access channel. These are considered very low losses in comparison with an estimate of 1,919 AAHUs for the much greater volume of disposal expected at the SF-DODS site, which could accept up to a combined 6 million cy per year of dredged material from an array of San Francisco Bay area channels (USFWS 1996). We have recently encouraged mitigation in situations where, as in San Francisco Bay, there is evidence of contamination of the dredged material, opportunities for alternative beneficial re-use of dredged material exist, and where the specific project under consideration contributes to much larger cumulative disposal impacts. This is not the case for Crescent City Harbor. Material from construction and maintenance of the project would represent a small increase in total disposal volume, the material is suspected to be free of toxic impacts, and the total disposal volume for SF #1 is relatively low. There are no known opportunities for beneficial re-use. We are unaware of other potential disposal activities which would contribute to a cumulative impact at SF #1. Assuming that (a) Crescent City Harbor is the sole source of material, (b) disposal does not exceed the volumes assumed in this analysis, and (c) USEPA "greenbook" testing shows no contaminants or toxicity, we do not recommend mitigation if SF #1 is selected as the disposal alternative for construction of an access channel at Crescent City Harbor.

Table 1. Habitat Evaluation Procedures analysis of impacts to two major ocean cover-types affected by disposal activities at the Ocean Site "SF #1" outside of Crescent City, California. The project life is 50 years. All SIs are assumed to be constant over the project life.

	Suitability Indices (SIs) X1	X2	X3	HSI	acres
Assume disposal of material from existing project maintenance only:					
open surface waters	0.85	0.60	0.95	0.80	31
deepwater benthos	0.80	0.60	0.70	0.70	128
Assume disposal from existing project plus maintenance of access channel to -14 feet MLLW, beginning TY9:					
open surface waters	0.84	0.60	0.94	0.79	31
deepwater benthos	0.76	0.60	0.67	0.68	128

	AAHUs* with project	AAHUs* without project	net change
open surface waters	24.54	24.80	-0.26
deepwater benthos	87.47	89.60	-2.13
TOTAL (both covertypes)			-2.39

*Average Annual Habitat Units

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APPENDIX E

AGENCY LETTERS OF CONCURRENCE

May 5, 1997

Mr. Wayne S. White, Field Supervisor
US Fish and Wildlife Service
3310 El Camino Avenue, Suite 130
Sacramento, California 95821

Dear Mr. White:

The following comments have been prepared by the Department of Fish and Game (DFG) as the agency exercising administration over fish and wildlife resources of California under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (43 Stat. 401, as amended; 16 US Code 661 et seq.).

The DFG concurs with the conclusions and recommendations of the Fish and Wildlife Coordination Act Draft Report for the *Crescent City Harbor Channel Improvement Measures Project, July 1996.*

Thank you for the opportunity to provide input on this report. If we can be of further assistance, please contact Associate Wildlife Biologist Karen Kovacs at (707) 441-5789.

Sincerely,

Richard L. Elliott
Regional Manager

cc: Ms. Karen Kovacs
Department of Fish and Game
Eureka, California

Mr. Ron Warner
Marine Resources Division
Department of Fish and Game
Eureka, California

bc: Mr. Mark Stopher

SEP 18 1997

Stopher:bd.Stopher's 1997 Environmental Revi

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

May 14, 1997 F/SWO:CTM

Mr. Joel A. Medlin, Field Supervisor
U.S. Fish and Wildlife Service
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

Dear Mr. Medlin:

Thank you for the opportunity to review the July 1996 draft Fish and Wildlife Coordination Act Report for the *Crescent City Harbor Channel Improvement Measures Project*. I concur with the report's findings and recommendations.

Sincerely,

James R. Bybee

James R. Bybee
Environmental Coordinator
Northern Area